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PROCEEDINGS
OF A
CONFERENCE
OF
REPRESENTATIVES OF THE BUREAUS OF PLANT INDUSTRY,
ANIMAL INDUSTRY, CHEMISTRY, AND STATISTICS,
OF THE UNITED STATES DEPARTMENT OF AGRICULTURE,
ON
VARIOUS PHASES
OF
INVESTIGATIONS IN THE TRANSPORTATION AND STORAGE OF
PERISHABLE PRODUCTS,
CONDUCTED BY THE DEPARTMENT OF AGRICULTURE.

January 13, 1910.

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A. H. Rawl

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ON THE
TRANSPORTATION AND STORAGE INVESTIGATIONS CONDUCTED
BY THE DEPARTMENT.

January 13th, 1910.

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THE UNIVERSITY OF CHICAGO

OF A

MEMORANDUM

TO

THE BOARD OF THE UNIVERSITY OF CHICAGO

FROM THE DEPARTMENT OF THE UNIVERSITY OF CHICAGO

AND THE OFFICE OF THE UNIVERSITY OF CHICAGO

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PROCEEDINGS OF A CONFERENCE ON THE TRANSPORTATION
AND STORAGE WORK OF THE DEPARTMENT OF AGRICULTURE.

(January 13, 1910).

A conference was held on January 13, 1910, at 10 a.m., in the Office of Assistant Chief, Bureau of Plant Industry, for the purpose of reviewing the work of the Department of Agriculture in connection with transportation and storage investigations. In addition to the members of the Committee appointed by the Secretary to consider this matter, viz., Mr. G. H. Powell, Chairman, of the Bureau of Plant Industry, Dr. M. E. Pennington, of the Bureau of Chemistry, Mr. B. H. Rawl, of the Bureau of Animal Industry, and Mr. Frank Andrews, of the Bureau of Statistics, the following were present: Messrs. W. A. Taylor, S. J. Dennis, A. V. Stubenrauch, J. D. Shanahan, J. W. T. Duvel, W. A. Orton, and L. C. Corbett, representing the Bureau of Plant Industry; Messrs. Geo. M. Rommel, B. R. Rogers, Robt. R. Slocum, K. E. Parks, and J. E. Downing, representing the Bureau of Animal Industry; and Dr. Geo. W. Stiles and Mr. H. C. Gore, representing the Bureau of Chemistry.

The meeting was called to order by the Chairman, Mr. Powell.

MR. POWELL: On account of the increasing interest that is being taken in the improvement of the facilities

REPORT

OF THE PROCEEDINGS OF A CONFERENCE ON THE TRANSPORTATION OF LIVESTOCK

(January 12, 1910)

1910

A conference was held on January 12, 1910, at 10 a.m., in the Office of Assistant Chief, Bureau of Plant Industry, for the purpose of reviewing the work of the Department of Agriculture in connection with transportation and stock investigations. In addition to the members of the Committee appointed by the Secretary to conduct this matter, viz., Mr. G. H. Powell, Chairman, of the Bureau of Plant Industry, Mr. H. E. Pennington, of the Bureau of Entomology and Plant Quarantine, Mr. W. H. Cresson, of the Bureau of Animal Industry, and Mr. Frank Andrews, of the Bureau of Statistics, the following were present: Messrs. W. A. Taylor, R. J. Dennis, A. V. Brown, J. D. Brown, J. W. Brown, W. A. Otter, and E. G. Corbett, representing the Bureau of Plant Industry; Mr. H. E. Pennington, of the Bureau of Entomology and Plant Quarantine; Mr. W. H. Cresson, of the Bureau of Animal Industry; and Mr. Geo. W. Smith and Mr. H. C. Gore, representing the Bureau of Statistics.

The meeting was called to order by the Chairman, Mr.

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MR. POWELL: On account of the increasing interest

in the subject of the transportation of livestock

of transportation and of the handling of products that enter into transportation and into cold storage, there has been a very lively interest on the part of producers and shippers, transportation companies and warehousemen in the work of the Department having to do with the transportation and storage investigations. There have been a good many requests made to the Department within the last few months to have the work along these lines extended and, as these requests come not only from individuals but from large organized bodies of individuals, and as we have had requests from another Department of the Government--the Interstate Commerce Commission--to have this line of work extended to develop facts and principles which might give a better understanding of the claims question, the Secretary recently appointed a committee consisting of representatives from the Bureau of Chemistry, the Bureau of Animal Industry, the Bureau of Statistics, and the Bureau of Plant Industry. He appointed the committee for the purpose of devising preliminary plans and policies in connection with the work in the Department as a whole. This committee met yesterday and had a preliminary discussion of what might be accomplished in the Department, and I think it was the feeling of every one in the committee that the time was ripe, that it was the psychological moment, for the extension of the Department's work along these lines, and that it was very desirable from the standpoint of the industries and from the

standpoint of the Department that the work should proceed along somewhat similar policies, and that there should be a clear understanding within the Department of the scope of the lines of work that are in progress. It was the feeling of the committee yesterday that it could not outline or make suggestions regarding the lines of work that were in progress in the Department without knowing these facts and that one of the easiest and best ways to get at them and to learn just what is being done in the different bureaus of the Department was to call this conference. We know that considerable work is being done in the Bureau of Chemistry on oysters, eggs, poultry, and along some other lines; that in the Bureau of Animal Industry there has been a great deal of work on dairy products, some work on poultry and other lines; and that in the Bureau of Plant Industry there is a good deal of work being done on fruits, grains, and various other products. From a discussion with the various members of the Bureau of Plant Industry and with members of other bureaus, it is evident that the lines of work that are being developed in the different bureaus are not always similar so far as general broad principles are concerned and that frequently the

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along somewhat similar lines, and that there should be
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of the lines of work that we in progress. It was the
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also see in the Department without further delay
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We want that committee's work is being done in the Bureau
of Industry on systems, eggs, poultry, and also some
other lines; that in the Bureau of Animal Industry there
is a great deal of work on dairy products, some
on poultry and other lines; and that in the Bureau
of Plant Industry there is a good deal of work being done
on cotton, flax, and various other products. There is
also a great deal of work being done in the Bureau of
Forestry and with members of a few others, in the Bureau
of the lines of work that are being developed in the
Bureau of Mines are not always similar so far as general
principles are concerned and that the various lines

work in the different bureaus has little relation to broad comprehensive problems.

A good deal of the work has to do with the development of isolated facts, but much of it has not been planned with a view to having it fit into a broad comprehensive effort to build up better methods of handling different types of perishable products that enter into transportation and storage. So this informal conference was called for the purpose of hearing from those in the different bureaus who are interested in transportation and storage investigations. The idea was not to develop details of work in different bureaus but to discuss the general scope of work that has been undertaken and the general methods of attack in handling the various problems. The committee felt that, after hearing this general discussion, through further conferences it might be able to outline a few general comprehensive problems in connection with the upbuilding of the methods of handling food products, so that the work of the Department as a whole would present a solid front and so that the work of the bureaus as a whole could be made to fit into the comprehensive plan which might be evolved from work of this type.

There is a different problem in this case.

...

A good deal of the work has to do with the handling of involved factors, but much of it has to do with the use of a system of having it all into a broad comprehensive effort to build up better methods of handling the various types of goods in a manner that will make the business and economy. To this is added a system of having for the purpose of coming from these in the different business who are interested in the business and the various factors that. The idea was not to develop the idea of work in different business but to show the general scope of work that has been undertaken and the various methods of attack in handling the various problems. The conclusion is that, after having this part of the business, though further extension it might be able to add a few general commercial problems in connection with the handling of the various types of handling these problems, so that the work of the department as a whole would have a better basis and so that the work of the business as a whole could be made to fit into the comprehensive plan which it is involved from a...

Mr. Taylor will give you a little idea first of the general scope of work in the fruit transportation and storage investigations, which was inaugurated some eight or nine years ago. I may say that this conference is entirely informal and you can fire questions at any one who is speaking at any time regarding methods of work, the general scope of work, or anything else that occurs to you.

MR. TAYLOR: I will first give briefly an outline of the work, quoting from the project under which the fruit transportation and storage work is conducted. The need of the work became conspicuously apparent in the summer of 1900. There was some desultory experimentation and some attention to fruit storage in the old Division of Pomology prior to that time, but the pressing need for more light in the interest of the producer, the consumer and the middleman became conspicuously apparent in connection with the behavior of fruits which were sent from this country to the Paris Exposition in the spring of 1900. This fruit was of the crop of 1899 sent for exhibition during the summer of 1900. A provision was made in the appropriation act that was under consideration in 1900 and 1901 for an investigation of fruit harvesting, marketing, storage and transportation, it being realized that all those features of the fruit industry were involved in the final behavior of the fruit in storage. The

Mr. Taylor will give you a list of the things that he

has done in the field of research in the

past few years, and you will find that he has

done a great deal of work in the field of

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objects as stated in our project are as follows: "To determine the factors that govern the successful transportation and storage of fruit. The project is presented under the following heads: (a) Influence of geographical regions on keeping quality of fruit." There was a very great dispute at the time in the trade as to the relative durability and storage behavior of some varieties from different orchard regions.

(Quoting again from "Objects" as given in original project statement):

"(b) Influence of local physiographic and cultural conditions on keeping quality of fruit. (c) and (d) Influence of methods of handling fruit in plantations, packing houses, in storage houses, and in transportation on keeping quality of fruit in storage and in transit."

It early became recognized that the refrigerator car in the fruit and storage problem was merely the vestibule to the storage house and that what happened in the vestibule had a very vital bearing on the behavior of the material later. The work in the early days was conducted simultaneously in four or five of the main orchard regions, duplicating tests of material that had been selected and packed with a view to securing uniformity in several storage houses in different parts of the country. One of the important things at that time was the question of the relation of storage and storage handling to the

development of apple scald. That was really the first serious problem that was attacked in a large way. Mr. Powell came into the Bureau specifically to take up this work, and this outline is very largely his, the work having grown, as you all know, under him.

The organization and cooperation as stated in the project was as follows: "All of the work is conducted by the Department except in the case of a sod-tillage test on the keeping quality of apples which is in cooperation with the New York State Experiment Station." That was continued for five years to secure a safe basis for generalization on that important point. (Continues reading from project statement): "The following stations have furnished varieties of apples from their experimental orchards" -- a large number of the eastern stations having varietal collections -- "for the variety tests in cold storage, though not under cooperative agreements: Virginia, New York State Experiment Station, Massachusetts, Maine, Michigan, Kansas." The relation of the work to outside organizations other than experiment stations was a close cooperation with the American Warehousemen's Association, California Fruit Growers' Exchange, the transcontinental railroad lines and certain individual storage houses which placed facilities at the disposal of the Department for the prosecution of the work. The method of procedure as stated briefly here is: "The investigations in fruit

storage are conducted by the storage of fruit from regions and orchards selected for the special problem in view.

The fruit is handled in accordance with the aim of the problem in view, and the behavior of the fruit is determined by frequent inspections in the cold storage houses to which the fruit is forwarded. The transportation investigations are conducted in the same general manner. The fruit is picked, packed and shipped under the direction of the Bureau representatives and inspected by a representative at destination."

You will, of course, appreciate that during the several years since the original formulation of the project, to agree with the project practice of the Bureau, there have grown up a number of modifications and amplifications. Some features that were emphasized strongly on the start have been carried through to a point where other features appear of more pressing importance, and they have either been completed or dropped to suit the apparent need of the time, but with that general outline we will perhaps get a better birds-eye-view of the work as it now is if we sketch briefly the project statement summarizing the work of the year 1909. After a brief statement of the project heads as previously indicated, these sub-heads are discussed: Orange and lemon storage investigations. For several years the orange has been the subject of work both in transportation and storage as well as in the packing house and grove preparatory to the storage period.

During the past year the experiment was conducted with two varieties of oranges picked at different stages of maturity and stored at two different degrees of temperature in a lemon packing house. The fruit was furnished for the experiment by the California Fruit Growers' Exchange without charge to the Department. It was inspected first after three weeks in storage and later at intervals of ten days, making six inspections in all. The results on the two varieties, Washington Navel and Valencia, are summarized but will probably not be of particular interest here. Certain pathological features have arisen which it is necessary to consider in shaping the future of this work.

Similarly in lemon storage, both fresh and cured, yellow and green fruit was stored at different temperatures, one at 32 degrees and the other at higher temperatures, varying from 40 to 45 degrees. It should perhaps be stated for those who may not be acquainted with the present commercial practice that the lemon is not considered a cold storage fruit in the trade. Experience has been rather disastrous in a commercial way, but commercial experience has been based on storage after shipment, and this is an effort to get at the relation of storage near the place of production to the behavior of the fruit in these different temperatures. It was demonstrated plainly that 32 degrees is entirely too low a temperature

at which to hold this fruit. It was also shown that cured lemons hold up much better than those freshly picked, the cured "green" fruit giving better results than the cured "yellow." This appears from one point of view a contradiction of the experience with deciduous fruits in storage in that the lemon appears to remain in best condition when stored prior to maturity. Of course, with the lemon the end sought is different from that in the case of other fruits, and in commercial practice the lemon is actually harvested much earlier in the life of the fruit than other fruits are.

Another important problem is the storage of table grapes. Our work with this crop is also done in California. Mr. Stubenrauch will indicate further the ways of conducting the work and give somewhat more in detail the results secured during the past year.

The third important line of work is the apple storage investigations, which have been proceeding in California with special reference to difficulties that have arisen in the behavior of the apples from the most important apple growing locality, commercially, of the Pacific Coast up to the present time, that is, the locality that has the largest production from a given area. The fruit has been found to turn brown internally far in advance of what would seem to be its proper time to break down, and, through a rather exhaustive comparison of apples grown on different soils, picked in different stages, and stored in dif-

ferent temperatures, effort is being made to locate both the cause of that deterioration and, if possible, to correct it. The working out of this will really determine whether the industry there survives or goes down.

In the lemon handling, incidentally connected with the storage but covering the whole handling of lemons from the tree through the curing tents and through all the preliminary treatment which lemons undergo on their way to the car for transportation, in distinction from cold storage--what we know as "tenting" and "house curing"--a large amount of work has been done by our people during the last year.

Another important line brings us to the point of precooling. The word "precooling" was coined to cover that treatment of fruit which reduces its temperature immediately after harvesting or as promptly thereafter as possible. In other words, it means an early and almost necessarily quick cooling before the fruit passes into its regular commercial movement. For this work we have secured some special equipment, and I will ask Mr. Dennis to outline briefly what has been done in that direction during this year.

MR. POWELL: May I bring out here that the fundamental reason for precooling is this: In the transportation of perishable products like fruits and vegetables it has been shown that the ripening processes are accelerated

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...which cooling before the fruit passes into
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...some special equipment, and I will ask Mr. Harris
...what has been done in that direction
...this year.

...: May I bring out here that the fundamen-
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...like fruits and vegetables is for
...that the ripening processes are accelerated

as soon as the product is severed from the tree; that diseases grow very rapidly at this time and that a large proportion of the commercial losses in the transportation and storage of these products is due to the fact that the product is not cooled quickly after removal from the tree; that in the ordinary refrigerator car, when the product is put into it in a warm condition, cooling takes place so slowly that the ripening may spring forward and disease develop during the early part of the trip while the product is being cooled down. As a means of overcoming these difficulties in transit and of lengthening and widening the geographical area over which the products can be distributed in sound condition, we have been investigating the effect of precooling upon the products, cooling them down quickly after they leave the tree. These investigations are made in comparison with the ordinary methods of shipment and several hundred cars have been compared under exact comparative conditions and through very careful temperature studies of cars under careful methods of shipment. It comes back to the general principle of the study of the effect of quick cooling vs. slow cooling and the relation of that to the commercial distribution of perishable products.

MR. TAYLOR: It was early found from comparison of fruit stored promptly after picking with fruits held a week or two weeks and then stored, that the fruits stored

as shown in the present in several cases; that
the growth was very rapid at this time and that a large
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storage and several other methods of storage. These
investigations are made under certain methods of storage
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at the effect of quick cooling vs. slow cooling and the
relation of that to the commercial distribution of various
products.

MR. TAYLOR: It was early found from comparison of
fruit stored promptly after picking with fruit held a
week or two weeks and then stored, that the fruit stored

promptly kept best and longest and could be shipped farthest. Precooling is merely an extension of that principle and a determination of the limitations that exist as regards time and temperature.

MR. SHANAHAN: I would like to ask if that cooling is all done by refrigeration.

MR. TAYLOR: The work has been undertaken both by natural precooling, such as is afforded by the night air in certain sections during the fruit harvest, and by experimental equipment for cooling in the cars just after the fruit has been packed and loaded, and by cooling in stationary cooling rooms. The question of the practicability and effectiveness of precooling by taking advantage of the temperatures during a certain period of the day has been under consideration and some work has been done along that line.

MR. SHANAHAN: Can you make any general statement as to the lowest temperature that you have used in your experiments; that is, I want to get an idea how much refrigeration it requires?

MR. TAYLOR: That depends largely upon the temperature of the product with which you start. Mr. Dennis' discussion will probably bring that out.

MR. SHANAHAN: Will it also develop the cost of precooling and refrigeration?

MR. TAYLOR: That question will vary so much with

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MR. WATKINS: I would like to ask if there is anything

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MR. WATKINS: ...the ...

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MR. WATKINS: Can you make any comment on the

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MR. WATKINS: That depends largely upon the ...

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MR. WATKINS: It is also possible that the ...

...the ...

MR. WATKINS: ...the ...

the product and the character of the plant and its location that it would be difficult to state anything definite.

MR. SHANAHAN: As a general proposition you found that this precooling, whatever it costs, has been profitable to the grower?

MR. TAYLOR: Not necessarily so at all. It is a very doubtful whether it would be advisable to precool New York winter apples.

MR. SHANAHAN: So far as your California work is concerned?

MR. TAYLOR: That depends largely on the time of year when the fruit is going to be harvested. The cheapest precooling of California oranges at this time of the year, for example, is to leave the ventilators open in the car while in transit but stopping short of freezing.

MR. POWELL: This general statement will hold, that any product that ripens quickly in warm weather can be distributed over a wide geographical area if it starts on its journey sound and cold instead of in a warm condition.

MR. SHANAHAN: The reason I ask is to find what application of the principle can be made to the grain business, particularly to the storage and transportation of corn.

MR. TAYLOR: Right here perhaps it should be said that in all this work more has been done on the Pacific Coast, and especially in California, than possibly the

The present and the future of the plant and the forest
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Mr. TAYLOR: Not necessarily so at all. It is a
very important question whether it would be advisable to proceed
with the winter studies.

Mr. SWANSON: So far as your California work is

concerned?

Mr. TAYLOR: That depends largely on the time of year
when the study is to be made. The winter study
of California is a very important question at this time of the year, for
it is to leave the vegetation open in the winter while
it is not yet dropping about of freezing.

Mr. POWELL: This general statement will hold, that

the forest that ripens quickly in warm weather can be
attributed over a wide geographical area it is a very
important question and is a very important question.

Mr. SWANSON: The question is whether the forest
of the principle can be made to the forest study
then, particularly to the storage and transportation of

Mr. TAYLOR: That is a very important question.
and all this work has been done on the Pacific
Coast, and especially in California. The question is

rest of the country put together--certainly within the last two or three years--and that has been deliberately done, not for the reason that California needed it worse, but for the reason that California has presented the best conditions in which to work an out-of-door laboratory on a large scale. The equipment in the form of railroads and storage houses and cooperative organizations, icing systems and systematized transportation has been such as to render practically an open-air laboratory available for work on a large scale at low cost, and in our work along those lines we look upon the State of California thus far as a laboratory in which to work out general principles that may be expected to be applicable, with more or less modification, to other sections of the country.

MR. POWELL: This should be added, too, that we have made it a practice never to go into any section until the section wanted us there very badly. We never go in primarily with the idea of doing missionary work.

MR. SHANAHAN: If the commercial interests of California had not been more interested at an earlier stage of the work than some other parts of the country, then the work would have been taken up somewhere else.

MR. TAYLOR: The growers were the first--perhaps not the first to appreciate, but certainly the first to openly state their conviction of the need in California. They were organized so that their desires had influence in se-

curing the facilities that otherwise might not have been so easily obtained. The industry was in a shape to be heard and to work effectively in cooperation with the Department and to compel cooperation from other industries and other interests that were needed in the cooperative work. On the start I must say that there was a good deal of hesitation on the part of some of the interests as to the advisability of their cooperation with the Department.

MR. POWELL: At first they thought it was police work.

MR. TAYLOR: Yes, a sort of detective bureau; at first that seemed to be the feeling. There have been many complications that have been considerably cleared up during this work.

MR. SEANAHAN: I think it would be found to be true of any work of this character that the commercial interests would be more or less suspicious.

MR. TAYLOR: Through a steady insistence and concentration upon a very few definite problems that were vital to the industry and to every man in it, that feeling of suspicion and to some extent of opposition has very largely disappeared, and the real difficulty in recent years has been to determine what to decline rather than what to accept in the way of cooperative assistance.

MR. POWELL: In this particular line of work it has been our practice from the start to keep it out of controversial matters that have relation to the enforcement of

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law; to keep it out of court and never to allow the data to be used by individuals in settling controversial questions.

MR. TAYLOR: In applying the results of the California work on oranges to Florida conditions, work has now been in progress there for three seasons, and it has not reached the refrigeration stage at all. It is a question of packing house handling and of the behavior of material variously handled, in the grove and packing house, while in transit, and after it reaches the market. It should perhaps be said right here in that connection that we have found it necessary to build up and maintain a "team" that can simultaneously have the material under observation continuously. It was not found practicable or advisable to leave any particular phase to be reported on merely by the commercial interests, and when occasion has arisen, it has been necessary to have men on the cars in transit in order to get at just what happened to the fruit--in order to get an accurate record of the ventilation service and an actual record of the temperatures and those various phases that occur.

MR. SHANAHAN: I understand there has been quite a number of material improvements made in the methods of handling fruit since you started this work. What I wanted to bring out was whether or not those improvements had increased the cost of the fruit as put on the market. The

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... of material improvements made in the methods of
... that I understand that the fruit is now
... out was whether or not these improvements had
... the cost of the fruit as put on the market. The

cost of handling commercial products is quite an important one and we may develop methods for putting these commercial commodities into ideal condition, yet the cost of putting them into that ideal condition may altogether preclude the possibility of using them.

MR. TAYLOR: Possibly an instance will throw some light on that in the way that we have seen it, insofar as it has worked out in our fruit work. Careful handling costs more than careless handling as a rule. It may cost, as it does cost at times, we will say, 10 cents a box more to carefully handle a crop of oranges than to handle it in a careless manner through the various operations.

MR. SHANAHAN: The ultimate cost?

MR. TAYLOR: We have records of large blocks of fruit that have cost that much more. Those blocks of fruit have sold in the open market, we will say, at 50 cents a box more. That has increased the amount that the producer has received for his work and his product, and it has not compelled anybody to pay the 50 cents more. It has tempted them to pay the 50 cents more because of the better quality. It has only added to the cost of living insofar as people have been attracted by a wholesome and attractive product and have been disposed, therefore, to take it rather than the inferior product.

MR. SHANAHAN: I believe that the same principle could be applied in the grain business if it could only

be demonstrated.

MR. POWELL: I would like to add that in this work we have been trying to combat one of the greatest economic fallacies that has prevailed in the handling of perishable products, that is, that it is profitable to do things cheaply. In the handling of the perishable fruit business (and I think probably that would apply to any other line of perishable products), the idea has been to develop systems of handling that will cut the price per unit down to the very lowest point, just as is done in handling coal or in handling any other inorganic product. This practice is a great economic fallacy when applied to a perishable product. Ultimately the product that reaches the consumer in the soundest condition is the product that has had the most expended on it to keep it sound. We have got that so thoroughly driven into some of the fruit industries that no business man at the present time would hesitate to spend 15, 20 or 30 per cent more in the preparation of his product.

MR. SHANAHAN: Have you got the middleman to understand that?

MR. POWELL: Yes. He knows it costs more to handle it, he gets more sound fruit, and he sells at a better price; where he used to get 110 good oranges, he now may get 126.

PROF. CORBETT: The unit cost of the orange is not really more to the consumer than under the cheap handling.

MR. TAYLOR: The freight bill is just the same on the rotten oranges as on the good.

PROF. CORBETT: There are certain fixed charges that do not change.

MR. TAYLOR: The freight bill does not all rest on the producer. The purchaser safeguards himself. If there is 10 per cent decay in a box of oranges or in a lot of oranges, the bidders at the sale protect themselves in their bids by bidding on a basis of more than 10 per cent decay. They safeguard their interest when they name their prices.

MR. SHANAHAN: It would seem, then, that it has been profitable to spend more money on the preparation of the fruit for shipment?

MR. POWELL: To the producer, yes. I will give one instance. In the case of one concern in California, three or four years ago it cost them 4 or 5 cents per box more to prepare their fruit for shipment than it did the preceding year. I think the extra cost of preparation for the entire crop amounted to about \$6,000, but by incurring that extra cost in preparation they saved about \$8,000 in icing charges alone. On that one item they were able to more than make up for the additional expense in preparation. Probably the net profit to the producer of that

PROF. GORDON: The next point of the change is the
weight, more to the consumer than to the change handling.

MR. TAYLOR: The first bill is just the same as

the second, changes as on the good.

PROF. GORDON: There are certain fixed charges that

are not change.

MR. TAYLOR: The first bill does not all come in

the same way. The producer receives it himself. It comes

in 10 per cent decay in a box of oranges or in a lot of

oranges, the bidder at the time makes the difference in

the bid by bidding on a basis of more than 10 per cent

decay. They safeguard their interest when they make

their bid.

MR. TAYLOR: It is not the same, but it is the same

profitable to spend more money on the transportation of the

fruit and the change.

MR. POWELL: To the producer, yes. I will give you

an example. In the case of one orange in California, there

is a very small amount of decay, but it is the same

to the producer. I think the entire cost of transportation for

the entire crop amounted to about \$8,000, but by increasing

the cost in transportation they saved about \$8,000 in

the same way. On the other hand, the cost of

transportation was up for the additional expense in transpor-

tion. Probably the net profit to the producer of that

crop was not less than \$30,000 or \$40,000.

MR. TAYLOR: This is a point that is likely to be in our minds at the present moment -- the relation of better handling to cost of living or to the burden carried by the consumer. It is optional with him still. There is not so much carefully handled fruit and expensively handled fruit on the market yet that the consumer who desires poor fruit can not secure it. He may not be able to get it as low as it is worth, but the reasons for that condition will have to be solved elsewhere than in the increased cost of handling that is necessary to insure delivery in a sound and wholesome condition.

MR. SHANAHAN: I am asking these questions in order that I may, if possible, apply the facts to our investigations relating to the grain business.

MR. POWELL: Those same questions will arise in the handling of any perishable product, whether it is poultry, eggs, milk, or any other.

DR. DUVEL: There is quite a decided difference where you are dealing, as you are in fruit, primarily with the individual; that is, you sell your fruit as individuals. If you can get ten more good oranges out of a box, there is that much more profit; but take grain which is handled in bulk--

MR. POWELL: Apples are handled by the barrel.

DR. DUVEL: But in corn you are handling carloads in bulk.

MR. POWELL: Suppose you raise the standard of the carload.

DR. DUVEL: You would have to revolutionize the business.

MR. SHANAHAN: That depends upon how grain is bought or sold. Within certain limits the quality of grain makes very little difference if bought or sold on inspection certificates, but if a dealer is buying for his own use he may pay a premium. Where the dealer has an opportunity to select the grain by sample, premiums are often paid for carloads of the better qualities.

MR. TAYLOR: What type of wheat goes into the higher priced flours?

DR. DUVEL: It may be almost any kind.

MR. SHANAHAN: Within certain limits there is practically no difference in the class of wheat that is used for the higher priced flours. Many millers use practically the same kind of wheat, while some of them command from 25 to 50 cents a barrel more for their flour. The only reason they can do so, so far as I can figure out, is that they advertise more extensively.

MR. TAYLOR: That element enters into any such proposition -- the business management of it.

MR. SHANAHAN: What we have to contend with in the grain business is this: That business has been developed very rapidly in the last twenty years and the method of handling and the apparatus for handling it have also been

THE CHAIRMAN: I have the honor to call the attention of the

Committee

to the fact that you will have to reconsider the

question

MR. CHAIRMAN: That depends upon how great is the loss
to the public. Within certain limits the public will not

very little difference in the price of grain between
the public and the dealer, but it is a dealer in buying for the public and

he will pay a premium. Where the dealer has an opportunity
to collect the grain by sample, premium will be given

and the collection of the public will be

MR. CHAIRMAN: What time of day does the public

usually buy?

MR. CHAIRMAN: It may be almost any time.

MR. CHAIRMAN: Will you please state the time

of the day when the public usually buys?

MR. CHAIRMAN: The public usually buys in the

middle of the day, with some of them coming

in the morning and some in the afternoon.

MR. CHAIRMAN: They can be so, so far as I am concerned, in

the morning or in the afternoon.

MR. CHAIRMAN: That is about all that I can say

in regard to the business arrangement of it.

MR. CHAIRMAN: What we have to consider is the

business arrangement of it. That business has been developed

very rapidly in the last twenty years and the method of

handling and the apparatus for handling it have also been

developed very rapidly, so that it is handled very quickly and in large volumes. It is mostly handled by middlemen, who have scant interest in the grain other than to handle large volumes of it for a consideration, and it is largely bought and sold on inspection certificates. In order that grain be bought and sold upon the basis of its actual intrinsic value per unit, a revolution of the grain business would be practically necessary. I think matters are tending that way.

MR. TAYLOR: In this connection I will mention first the change that has occurred in the whole point of view of the apple trade; for example, in relation to the handling of the apple crop or of that portion of it that is needed for storage. When the work began there was a firm conviction in the minds of practically all the apple trade that apples needed to be picked green and hard to keep well in storage. The question of how long it took to get them from the tree into the storage house, or what happened to them while on the way there was very largely ignored. It developed that instead of keeping better they kept less well when picked prematurely, and the whole attitude of the trade has changed to a very considerable extent in regard to this, our most important fruit, taking the country as a whole. There has been, as a matter of fact, a very general adoption by the trade of the conclusions reached in the apple storage work insofar as apples grown

east of the Rocky Mountains are concerned. Then again, as to the method of handling the citrus fruits in the packing houses, my first visit to California (that was before this work began) disclosed packing houses almost like flour mills or machine shops, full of complicated machinery, and the whole tendency was in that direction -- to cut down the labor cost and substitute for labor mechanical devices. Mr. Powell's work very quickly developed that each additional handling that the fruit received hurt it and that that hurt could not be cured; that it was a question either of prevention or of continuing with the heavy losses, and the whole packing house equipment in the citrus fruit region has been changing since then and readjusting itself, necessitating a somewhat increased cost, a somewhat higher labor cost, but getting their money back with profit through the higher prices received and the lower losses in transit and storage.

PROF. CORBETT: Are those higher prices considered on the basis of the number of sound oranges in the box?

MR. TAYLOR: The prices come in the ratio of sound oranges per box. The buyer knows when he pays \$3 for a box of sound oranges that there are 200 sound oranges in the box and he will get that number to eat or to sell. If he buys a 200-orange box with 10 per cent decay indicated, he knows there is a 10 per cent decay and he concludes there is more than 10 per cent or that there will be before the fruit is used, and he discounts the price.

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He over-protects himself invariably.

MR. STUBENRAUCH: Does not the fruit-stand man have to charge a much higher price to the consumer for this fruit, taking into account the loss for decay, than he would if he got a whole box of sound fruit so that the increased price he has to buy at does not actually increase the price to the consumer?

MR. TAYLOR: That might so work out, but I suspect the seller puts on the price that he thinks he can get as a rule.

MR. STUBENRAUCH: Formerly he had to charge enough per dozen or apiece to make up for the loss which he inevitably expected from decay; he had to charge extra to make that up. Now he finds that he does not have to take into consideration that factor and by paying a little more per box for sound fruit he does not actually have to increase the price to the consumer.

MR. TAYLOR: That may be true in certain cases, but in general the retailer endeavors to protect himself, leaving out of the question entirely the very important factor of stuffed pack, which in some of the fruits is almost the predominating feature of the trade.

MR. SHANAHAN: I suppose it has more ready sale on the market because of its better appearance.

MR. TAYLOR: That to my mind is the reason. He merely puts up certain prices and we are attracted by the appearance of the fruit and take our choice as to what we

will buy.

MR. POWELL: I do not think any one in the Department needs to feel discouraged if he finds that a commercial practice is wrong. If he finds that the results of his investigation establish that a commercial practice is wrong, even if the practice has existed for twenty years, I do not think anybody needs to feel discouraged about the impossibility of tipping over that old commercial practice.

MR. SHANAHAN: I agree with you.

MR. POWELL: I believe any commercial practice can be tipped over in one year if we have the absolute facts worked out through careful laboratory work, supplemented by field investigations. I do not think we have a right to expect any industry to change unless our data is developed on a very extensive commercial scale supplementing our very careful research work in the laboratories. Take the citrus industry with a hundred million or so invested. We would not ask the citrus industry to change a commercial method that has existed since the beginning of the industry unless we had enough commercial data that are absolutely conclusive and sufficient to take the matter out of the controversial phase and put in on a demonstration basis. When you have those data, then the practices that may have come down for generations will tip over as a result of the work.

MR. SHANAHAN: There are many cases that you would never reach if you waited until the community asked you to come in and do the work.

MR. TAYLOR: I will mention our transportation investigations which for two years have been carried on with a view to conducting simultaneously a study of packing methods, the behavior in California in storage, and in the market -- that is, the market behavior after reaching destination. With such perishable products as we are working with it would be entirely insufficient if we stopped short of following the material through until it reaches the consumer, because the consumer is the man who finally determines what price the producer will receive, and who is governed largely or for a good while by tradition, practice, experience, etc., and is slow to change. We need to get into the shoes of the consumer in every operation that we conduct that involves the handling of perishables. So we endeavor to follow the behavior of that material through the usual consuming period after it reaches its market. Now, in this work there have grown up several contacts. We have for years, almost from the beginning, had a contact with the Bureau of Chemistry, and a very satisfactory one to us it has been, through Mr. Gore's work, which has in many features been supplemented by attacking problems that appeared of interest to us in connection with this work and upon which we cooperated,

although maintaining an entirely separate bureau responsibility. It has not been found difficult at all to cooperate continuously and quite effectively and, I think, most of the time good naturedly. We have had various contacts within our own Bureau, particularly with our pathologists, and we have pressing upon us at this time need for much closer contact with the pathological work in certain of these places. Just how it will be best to work it out is at the present time under consideration. We have had also cooperative contact with the Bureau of Soils in places where particular problems appeared to need more light on the actual soil types and conditions so that the product of a particular soil type could be contrasted with another grown under like climatic conditions.

MR. POWELL: I would like to bring up in connection with what Mr. Taylor has said that "Fruit Transportation and Storage Investigations" is a misnomer. It is a convenient handle. The object of this work has been, first, to determine the fundamental factors which govern the ripening processes and the keeping of fruit products. The second object of the work has been to apply the facts and principles coming out of those fundamental investigations to the methods of handling the products in the field, in transportation and storage. The storage and transportation has only been a convenient means to an end. The object of the work primarily is a campaign for building up

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MR. POWELL: I would like to bring up in connection
... what Mr. Taylor has said that "Fertilizer Investigation
... and Storage Investigation" is a minor one. It is a con-
... problem. The object of this work has been, I think,
... in the past the fundamental investigation of
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... of the work has been to apply the facts and
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... in the handling of their products in the field, in
... transportation and storage. The storage and transportation
... of the work primarily is a question for dealing with

better methods of handling all sorts of food products. The work has been organized and the problems taken up from the growing side of the fruit industry, the handling side, the storage side, the transportation side, and the market side, making the facts and principles that come out of the investigations along these lines dovetail into a general effort to bring about better methods of handling fruits. The California work has not been done for the Californians; it has been done as a means to an end. The fruit industry in California is organized, and transportation has been such that our investigations could be done better there than in any other part of the United States. But this has been a very striking principle that has underlaid all this work -- that it is not a cold storage investigation, nor a transportation investigation, but that transportation, storage, and all of those factors have simply been made to dovetail into the problem, which has been to bring about better methods of handling food products with a view to a further distribution and extension of markets through better handling and better transportation systems.

Mr. Stubenrauch will tell us briefly something about the method of handling our grape problems in the field.

MR. STUBENRAUCH: The grape problem was taken up about four years ago, first from the cold storage side with two objects in view, one of which was an extension of markets by means of cold storage and an extension of the

season of marketing by means of cold storage and a study of the relation of packing and handling to the keeping quality in cold storage, on the one hand, and the relation of packing, package, and handling methods to keeping quality with reference to the carrying quality of the fruit, on the transportation side. We had no precedents to go on except the shipping of table grapes from Spain packed in cork dust. Our method was first to select a number of varieties of table grapes, some of which are grown commercially and some of which are not, and study their behavior in cold storage, packing them in different ways. We found it necessary to begin at the foundation and do all the work ourselves. We did all the picking so as to be sure of the careful handling of the fruit and thereby learned a great many facts concerning the handling of grapes which would not have been apparent otherwise. We learned how easy it is to damage grapes by careless handling; we learned just at what points the greatest damage was done. Then we studied the relation of the package -- the open commercial crate, which is a four-basket carrier, holding about five pounds, as compared with a filler of some kind, such as cork dust. Cork dust was taken as a standard for comparison, as we knew that grapes could be handled in that way from Spain. Other materials were used, such as shredded paper, corn pith, and ground tule (a material which grows out there in large quantities), wheat

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bran, cornmeal -- anything we could think of that might be useful, and then redwood sawdust. Now, briefly, we found this: that in all cases where the fruit was packed in the open crate, in the ordinary commercial crate, it did not hold nearly so long in cold storage as when a filler of some kind was used, and we found further that redwood sawdust made a better filler than the cork -- fortunately for California conditions, where the cork is too high priced to use. We found that the cheaper material produced right at home was very much better and held the grapes longer in cold storage and in very much better condition. This work was carried on successfully and repeated for several years until we felt absolutely sure of the results obtained.

The last two years these investigations were extended to the transportation stage, at the urgent request of grape growers and shippers of the Lodi district, where the largest quantity of table grapes are produced. We extended these investigations to the transportation of the grapes, and the methods used in carrying on that work were similar to those pursued in the orange work, using as the basis of our transportation work the results which were obtained in the cold storage investigations. The method consisted simply of going among the growers and getting material commercially handled as compared with the same put up by ourselves or under our immediate supervis-

ion, very carefully handled, and some fruit packed with a filler (cork dust and sawdust), and then shipping through to New York, where our own inspectors received the fruit and carefully looked it over and actually determined the amount of decay or deterioration. So we had a number of packages going forward to the East packed under exact conditions and shipped under exact conditions, and we actually compared them on arrival, and also three, five, and seven days after arrival, so as to get some idea of their market condition. We shipped out the first season about twenty cars, and last year, the second season the work was carried on, 33 cars were sent east. I might read just briefly the results of some of the work this year.

MR. POWELL: Suppose you give us the general plan of carrying on the shipping experiments rather than the details of results. How do you handle such shipping experiments?

MR. STUBENRAUCH: Our shipping experiments are conducted by men in the field through cooperation with the growers. Unfortunately in Lodi they are not organized as they are in southern California, and we had to go back to the individual grower rather than to an organization. We first held meetings and got the growers interested in the work and then selected certain representative places in the district, giving us a representation of the younger vineyards and vineyards on various kinds of soil, carrying

on the work from the beginning to the end of the shipping season. We would select a place and go there and take a certain number of crates of this man's pack of the day, and alongside of that we would put up ourselves or under our immediate supervision the same number of crates very carefully handled, just as carefully as we knew how, so as to absolutely insure the sound condition of the fruit in the package. We would also pack and very carefully handle a similar number of packages of the same fruit put up in cork and sawdust. These were shipped in cars going to New York, having our man examine them on arrival. Alongside of that we also conducted a number of demonstrations in Lodi in order to show the growers the condition of their fruit on arrival. There is not one shipper in a thousand who knows what the fruit looks like after it arrives. We did this by having an iced car at Lodi and for every shipment which was made a duplicate set was put into the car and held in Lodi, and, when we got word back from New York that shipment had arrived, we took these crates out and displayed them to the growers, thereby enabling them to see the results of the work with their own eyes rather than simply taking our figures. I might say that the demonstration side was the most effective in bringing about an improvement of handling, and we found an improvement in the methods of handling the fruit the second season

after we started.

MR. POWELL: That was a very important side of the orange work where we carried on duplicate demonstration experiments in a number of different sections in California in addition to the regular shipping work, and it did much to bring about a change in the methods of handling. We found that demonstration work in the field where it is carried on over and over again in a large number of sections has been very important in driving home changes in methods.

MR. STUBENRAUCH: We found the growers and shippers very much interested in these results and in some instances very much surprised at what we found. Some of them did not know their own packages after they had been through the car.

MR. TAYLOR: You say the time of transit is how long?

MR. STUBENRAUCH: About two weeks, usually. The transcontinental trip takes about two weeks, and we adopted methods of having the inspector telegraph back so that we actually know the results as soon as they can be seen. These local demonstrations were the means of keeping the growers interested in the work and actually showed them what was happening.

PROF. CORBETT: Did you find the local demonstration tallied very closely with the actual commercial shipment?

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DR. TAYLOR: You say that kind of results is how

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DR. TAYLOR: Did you find the same commercial equipment?

MR. STUBENRAUCH: Very closely, taking into consideration the different men conducting the inspections, because with grapes it is a very difficult matter to get any accurate data, that is, any accurate calculation of the amount of decay, and the only way we could do that was to take the different packages and cut apart the bunches, segregate the decayed berries, and determine the actual percentage of the decayed berries. That was actually what we did.

MR. TAYLOR: You based your conclusions on the behavior of the individual berries?

MR. STUBENRAUCH: Yes.

PROF. CORBETT: One question that came up in my mind was as to whether the jostling and jarring of the fruit had anything to do with this deterioration in transit.

MR. STUBENRAUCH: Not that we could find. In some instances we found more decay in our car at Lodi than we did in New York, but not always. The conditions were rather more favorable at Lodi than they were in transit for the reason that we had comparatively few packages in a car and a very large volume of cold air, and another thing -- we could cool it very quickly, much quicker than in a closely packed car in transit.

DR. DUVEL: When you speak of shipments, you mean there were a certain number of cars in which you had boxes?

the different methods of the investigation, but
with groups is in a very different manner to get
any accurate data, that is, any accurate collection of
the amount of stock, and the only way we can do this
is to take the different products and add up the
totals, ascertain the amount of product, and ascertain the
percentage of the different families. That was ac-
cording to what we did.

MR. TAYLOR: You based your conclusions on the per-
centage of the individual families.

MR. TAYLOR: One question that came up in my mind
was as to whether the handling and gathering of the birds
had anything to do with this distribution in families.

MR. TAYLOR: Now, that we could find. In some
instances we found more birds in one set than in another
set in New York, but not always. The conditions were
very much different at least than they were in other
places. The reason that we had comparatively few birds in
one set and a very large volume of birds in another
set -- we could not tell exactly, but perhaps there
was a closely packed set in family.

MR. TAYLOR: When you speak of different sets, do you
mean a certain number of sets in which you had families

MR. STUBENRAUCH: Yes. The first year we had nine boxes in each car. This last year we had eight in each car.

MR. TAYLOR: Where were those placed?

MR. STUBENRAUCH: One on the lowest tier and one on the top tier this last season. The grapes are stacked in the cars nine boxes high, and we wanted to get at the difference between the lower part of the car and the upper. Crates were also placed about midway between the highest boxes and the lower, so as to get about the average conditions in the car.

MR. ORTON: You did not try to test all the grapes in the car?

MR. STUBENRAUCH: Just the boxes in the car which we marked. All we asked of the shipper was to see that the cars went to New York, and there was only one instance where a car was diverted. They were kept going right through to New York.

DR. DUVEL: There is one difference between the fruit work and the grain work. Grain is handled by carload, and it is almost impossible to get the shipper to consider anything else.

MR. TAYLOR: It should be said in this connection that in the fruit transportation work it has become clear that the carload is the unit that must be considered. The carload is a unit which is a definite and tangible thing,

Q. Now, the first time you saw the car, was it in the street or in the garage?

A. Yes, it was in the street. It was on the lower tier and one on the top tier this last morning. The garage was attached in the rear, and we wanted to get at the difference between the lower part of the car and the upper. There were also some other things, but I don't know. And the lower, as to get about the same as the upper is the car.

Q. Now, you did not try to test all the things

in the car?

A. Yes, I did. The first time I saw the car

was when we went to New York, and there was only one instance where a car was diverted. They were kept going to New York.

Q. Now, there is one difference between the two cars and the grain work. It is in the hull, and it is almost impossible to get the hull to contain anything else.

A. Yes, it is. It is in the hull, and it is almost impossible to get the hull to contain anything else.

although its behavior and what goes on in different parts of the car may differ. It is necessary to consider the carload as a unit and therefore be able to take samples. This involves the placing of the samples in the beginning-- samples of known history at known points in the car, so designated that, whatever happens to them, when the car is unloaded their marks will show their identity. Then base the inspection on this. It is like taking a sample of grain from the different parts of the car.

DR. DUVEL: I brought this question up more than anything else from the standpoint of the matter of settling losses, because when you have to settle the loss on an entire carload it would be a big item and would require considerable funds.

MR. STUBENRAUCH: In our grape work we actually purchase the grapes which we use. We had to do it; otherwise the loss would fall back on the individual growers. In the case of the orange work the fruit was contributed by the Exchange, so that we were not actually put to the expense, except in a few cases where we had to purchase the fruit, but in the grape work the fruit was ours; we bought it, put it up in any way we wanted it, and handled it just as we wished. All we asked the shipper to do was to see that the car went to New York, and we selected New York because it was a central point and gave a complete trans-continental trip.

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MR. POWELL: Are there any more questions in regard to the general method of handling the problem? If there are not, I think we all like variety and we will change from Plant Industry and hear about some of the general problems and the development of the work along storage and transportation lines in the Bureau of Animal Industry.

Mr. Rawl.

MR. RAWL: I shall not attempt to give you any of the details of our work, but rather just in a general way the lines of work that we are conducting. We have not been working on any of the dairy problems from the standpoint of transportation directly. We have done some work on some problems that are more or less connected with the big question of transferring raw material through the factory to the consumer, but we have not done it with that end in view, and therefore our problems are perhaps not connected up.

One of the lines of work that perhaps has been the most important in our Division has been in connection with the storage of butter -- the manufacture of butter for cold storage. We have done considerable work at the factory and we have done considerable work in the storage house. Of course, holding butter from the summer season when it is cheap and plentiful to the winter season when the price is highest is a very important part of the butter

business. I will ask Mr. Rogers to give you some outline of the character of the work that has been done in the factory and in the storage house. We have done very little on the transportation problem, but we have planned to do more work than we have heretofore.

MR. POWELL: Are you going back to the farm handling of the milk?

MR. RAWL: Not in this particular line of work. We do in our investigations of the manufacturing problem go back to the farm, because when that problem is taken up it necessarily leads one back to the farm. We must have good raw material at the factory and we can get it only from the farm. This work in a general way may be considered a portion of the transportation problem. We have been working for the past three years in cooperation with the Wisconsin Experiment Station on cheddar cheese. There again the transportation problem has not been taken into consideration except incidentally in connection with the manufacturing problem. Our experiments have taken us back from the factory to the producer of the raw material, and the question of transportation has not so far been given a great deal of consideration.

MR. POWELL: Do you carry on this work in cooperation with some of the stations?

MR. RAWL: Yes, and with other organizations that are interested. For instance, we have a creamery in

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MR. POWELL: Do you carry on this work in your spare

... with some of the students?

MR. HART: Yes, and with other organizations that

... are interested. For instance, we have a connection in

Minnesota, which we control to the extent of using it for experimental purposes whenever we desire. We are also co-operating with the Wisconsin Experiment Station and the Storrs Experiment Station.

MR. POWELL: Do you cooperate with any of the bureaus within the Department on any phases of the work?

MR. RAWL: Not on this particular problem. In connection with the transportation of milk we have done a small amount of work in cooperation with the Bureau of Chemistry. We have studied the milk problem, which involves transportation in a good many ways. The milk for Boston and New York sometimes is shipped as far as two or three hundred miles. That is a condition that probably does not exist anywhere else in the United States. It is simply a question of handling the milk in the cars for two or three hours, and the transportation problems involved there are entirely different from problems involved in shipping from one side of the continent to the other. The transportation problem here was only an incident to the other work. Mr. Rogers will give you some particulars regarding the butter experiments in connection with manufacturing and cold storage problems, as he has developed some of the best work that has been done in that connection.

MR. ROGERS: As Mr. Rawl has said, we have not gone into the transportation problem because there have been so

Minneapolis, which we wanted to be a part of what is now
operating with the Wisconsin Department of Agriculture and
Forest Service.

MR. POWELL: Do you cooperate with any of the business
within the Department on any phase of the work?

MR. HART: Not on this particular problem. In con-
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transportation problem here was only as related to the
Agriculture. The Department will give me information
regarding the future experiments in connection with trans-
portation and will make every effort to be in touch
with the best work that has been done in that connec-
tion.

MR. POWELL: As Mr. Hart has said, we have not done
much on transportation problem because there have been no

many other things more pressing and because the transportation problem is not so important in the handling of butter as it is in connection with fruit, for instance. Where you have fruit in transit for two weeks, butter is only on the road for a few days, and the only essential things in the transportation of butter are the frequency of the service, that is, how long the creameries have to hold it in their refrigerators before they can ship it out; how quickly the butter is transported, that is, how much delay there is between the creamery and the cold storage or the market; and the temperature of the cars. If that problem is taken up, those are the three things which should be determined first. As Mr. Rawl has said, we work more on the storage of butter, of which the transportation is only a part. Of course, as some one remarked, the refrigerator car is the vestibule of the cold storage, and it is probable that butter may deteriorate more in the few days that it is in the creamery refrigerator (which is usually a very poor one) and in the refrigerator car than in real cold storage for weeks or months. The temperature of commercial storage of butter is very low -- from around zero to 10 degrees Fahrenheit below.

MR. TAYLOR: How long has it been that low?

MR. ROGERS: It has been working there very rapidly.

A few years ago they were careful not to freeze butter,

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low -- from around zero to 10 degrees Fahrenheit below.
MR. TAYLOR: How long has it been that low?
MR. WOODWARD: It has been ...
A few years ago they were careful not to freeze butter,

but now the best cold-storage houses will guarantee a temperature of zero or below, even five below, and frequently maintain temperatures that never go above five and frequently go down to ten below.

MR. TAYLOR: There has been a very great change in the matter of butter temperatures since the fruit work started, as we have observed in our contact with storage people. They have recognized the fact that their butter storage problem was not solved by their commercial practices.

MR. ROGERS: In the small town the cold storage of butter is comparatively unimportant. They have only the ice and salt methods and they get temperatures of perhaps 20 to 25 in the good houses, but most of the butter goes to the big centers and is stored at these very low temperatures. Our work has been to determine the causes that bring about the changes in butter in storage and methods of controlling these causes.

MR. POWELL: It has been primarily a storage problem?

MR. ROGERS: Yes. Of course, butter that will keep well in storage is usually better butter when it is fresh, although that is not necessarily so. In working this out we have established our laboratories in Minnesota where we can carry on our laboratory work under commercial conditions. We move our entire laboratory force out there in the summer and work for three or four months making ex-

Now the best cold-storage houses will maintain a temperature of zero or below, even five below, and they usually maintain temperature that never goes above five and frequently go down to ten below.

MR. TAYLOR: There has been a very great change in the matter of butter temperatures since the war started, as we have observed in our contact with foreign people. They have recognized the fact that in butter storage problem was not solved by their commercial practices.

MR. ROBERT: In the early part of the war butter is comparatively unimportant. They have only the old and half methods and they get temperatures of perhaps 30 to 35 in the cold houses, but most of the butter goes to the big cities and it is difficult to get it down to the point where it can be used for butter. One would like to determine the cause of that thing about the change in butter in storage and the change of temperature.

MR. ROBERT: It has been probably a storage problem. MR. ROBERT: Yes. Of course, butter that will keep well in storage is usually better butter when it is fresh, so that that is not necessarily so. In winter, when we can carry on our importation with more confidence, we can carry on our importation with more confidence. The butter is not so good as it was in the past and that is one of the reasons why it is not so good.

perimental butter which we carry in storage in our experimental storage rooms in Chicago. We have three rooms there in which A. Booth & Company maintain any temperature we desire. For two years we maintained these at certain temperatures -- zero, ten below and ten above. In these rooms we have stored butter made under a great variety of conditions and from different grades of cream, creams of various acidities, and varying in a great many ways, in an endeavor to get at some fundamental reason for these changes. Without going into the details of the results, I may say that we have found that the temperature necessary for storage depends entirely upon the quality of the butter; that is, for the greater part of the butter that is now made from poor cream or cream that comes to the creamery in a sour condition, it is necessary and profitable to maintain very low temperatures; but with butter properly made, it can be stored and come out in fully as good condition at temperatures probably 20 degrees higher than is now maintained. We have found, for instance, that butter made from cream of very low acidity will keep at ten above very much better than acid cream -- even cream that is made under the best or most approved creamery practices but which is acid -- will keep at ten below. The changes in a general way are in proportion to the amount of acid developed in the cream. Don't understand me to say that this is the only factor that controls it, but

that is one of the many factors. The changes in butter are very complicated and are doubtless brought about by very many different causes.

MR. POWELL: How do you handle these various experiments; do you go into the factory and actually create the product that you are going to handle and study?

MR. ROGERS: Usually we take the best raw material that we can get and vary the conditions or make our own conditions. We are pretty well equipped for that.

MR. POWELL: I think that is a very important point in investigations of this kind. You can not go into the market and get material and make a profitable study of it.

MR. ROGERS: It is extremely difficult to get any consistent results anyway because we have to depend, for determining changes in the butter, on the ability of the butter judges to recognize the change in flavor in the butter and, of course, that must necessarily be a very varying standard.

MR. POWELL: An elusive thing.

MR. ROGERS: Yes. The chemical changes are so slight and so little ^{is} known about them that we can not measure the changes in the butter by any chemical standard and so we have to depend upon the sense of taste.

DR. PRATTINGTON: Have you done anything with the keeping quality of the butter after it comes out of stor-

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age, following it to the consumer?

MR. ROGERS: We have not done much in a commercial way. We have done it by holding it ourselves, and I might say in a general way that the effect of storage is merely to retard the changes that take place in the butter. I do not believe that the storage in itself affects the butter but merely the rate of change. Butter that is preordained to become bad or develop certain flavors will almost invariably develop those flavors sooner or later, and when you take that butter out of storage it develops those flavors much more quickly.

DR. PENNINGTON: Are the changes in storage just the same changes that occur at ordinary temperature except that they are slower?

MR. ROGERS: Not necessarily. For instance, if you hold it above freezing or near freezing you might introduce new factors. Certain organisms may grow there; you may get yeasts, for instance, certain kinds of yeasts being very apt to grow in butter at low temperatures. That will depend on the amount of salt and acid and on various conditions.

DR. PENNINGTON: Then you may have two very divergent lines in the decomposition of butter in ordinary temperature and at low temperatures?

MR. ROGERS: You may. Then, too, you get in storage

certain flavors that you do not get out of storage. There is what is known to the commission men as "cold storage flavor," which is very typical of storage butter, and when I find that flavor I know very well that the butter has been in cold storage as you never find that flavor anywhere else. But most of the flavors are flavors that would occur anyway.

MR. POWELL: Most of the difficulties arise out of storage. That interests me from this standpoint: that your better storage problem is just like the fruit transportation and storage problem. It is a handle for driving home better methods of handling the product before it goes into storage. The main part of the problem lies back of the factory.

MR. RAWL: Yes, back of the factory.

PROF. CORBETT: Back to the land.

MR. ROGERS: To a very large extent. But even a good butter maker, making the butter under the most approved methods and handling his cream carefully, can not make out of that cream butter that will keep in storage. He can make butter that will be good when it is fresh but will not keep in storage.

MR. RAWL: Mention the method that you have worked out for overcoming that.

MR. ROGERS: If we can get cream that is sweet when it comes into the creamery, we can make butter from that

...flavor is not out of storage. There is a known to the manufacturer as a "flavor" which is very typical of storage butter, and when I find that flavor I know very well that the product has been in cold storage and has never been "flavor" any more of it. But none of the flavors are flavors that would be out of storage.

MR. BOWEN: Most of the difficulty has been out of storage. That interests me from this standpoint: that the butter is not in storage. It is a problem for distribution and storage problem. It is a problem for distribution and storage problem. It is a problem for distribution and storage problem. The main part of the problem is back of the factory.

MR. HALL: Yes, back of the factory. That is the fact. MR. BOWEN: To a very large extent. But even a good butter maker, making the butter under the best of proved methods and handling the cream carefully, can not get out of that cream butter that will keep in storage. It is not in storage.

MR. HALL: Mention a method that you have working out for overcoming that. MR. BOWEN: If we can get cream that is good when it comes into the country, we can make butter from that

which would keep very much better than butter from the same cream made by commercial methods; we could make butter that will keep very much better in cold storage and which will pass for good butter.

MR. POWELL: Have you been able to establish the factors in connection with the farm handling, factory handling, and handling all along the line that make the best butter -- the fundamental principles that lead to the making of good butter?

MR. ROGERS: Some of them. I would not undertake to say all of them.

MR. POWELL: That is your fundamental problem, is it not, and all of the work is simply dovetailed into this fundamental problem?

MR. ROGERS: We are trying to work these things out one at a time. We soon found we had so many strings that it was useless to attempt to solve at once all of the causes of changes in butter. If we get one out in the course of two or three years we think we are doing very well.

MR. POWELL: This is a very much more complicated problem than the fruit work; yet your general problem is that of getting at the fundamental factors that make for good butter, from the field up.

MR. TAYLOR: Can you cure bad butter?

MR. ROGERS: I have not been able to do so. Some of

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MR. POWELL: This is a very much more complicated
system than the first one; yet your general problem is
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good butter, from the field up.

MR. HOLLAND: Can you come back butter?
MR. POWELL: I have not been able to do so. Some of

the commercial people have been more successful than I have. As probably most of you know, a very large proportion of the butter -- I suppose nearly all of the ordinary butter that we get in Washington -- is made in what we call central plants, where the cream is separated on the farm in hand separators and shipped, usually by express, to creameries in large cities where they make very large quantities of butter. There is one creamery that makes forty or fifty thousand pounds of butter a day.

MR. TAYLOR: How far is that cream shipped?

MR. RAWL: Sometimes as far as five hundred miles.

MR. ROGERS: That cream, you understand, may be held on the farm several days before shipment.

PROF. CORBETT: Sometimes shipments are only made two or three times a week.

MR. ROGERS: Sometimes once a week, and in the summer time you can imagine the condition of that cream. Yet these factories have been able to make from that material butter that they can sell. I would not undertake to do that. More than that, those central plants make butter that most of us eat.

MR. POWELL: Do you make comparisons of the effect of the various commercial methods of handling butter on the farm and in the factory on its chemical and bacteriological condition?

MR. ROGERS: We do not attempt it chemically and

I am not sure that I have been very successful in my
efforts to get you to go to the factory, a very large factory
and of the butter -- I suppose nearly all of the ordinary
butter that we get in Washington -- is made in that way
and it is not very good. It is not very good in fact
and it is not very good in fact, usually by experts,
to compare it in fact of the butter that we get in
Washington of butter. There is one company that makes
butter of this kind, I think of butter a day.

MR. TAYLOR: Now far is that cream shipped?

MR. HARRIS: Sometimes as far as five hundred miles.

MR. TAYLOR: What cream, you understand, and the butter

is not from cream, but from butter.

MR. TAYLOR: I am not sure that I have been very

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MR. HARRIS: Do you have any visions of this of not

for the various countries without of handling butter on

the same and in the factory on the standard and practice

and we do not have the standard and

bacteriologically except with the butter we make ourselves experimentally, but we are storing butter made under various commercial conditions.

MR. POWELL: Do you start out, we will say, with the same kind of cream, the same kind of raw material, and make it up under farm conditions and under the various factory conditions, so that you can compare products made under the different methods of handling?

MR. ROGERS: A great deal of our butter, of course, represents actual conditions, but a great deal more of it does not compare at all with commercial conditions; for instance, when we acidify cream with hydrochloric acid it would hardly compare with commercial conditions.

DR. STILES: To what extent is pasteurized cream used in making commercial butter at the present time?

MR. ROGERS: In the central plants it is practically all pasteurized and a great deal of it is neutralized with lime, and, if they want to sell it for making ice cream, they dilute it with skimmed milk and skim it over again. But in the ordinary small cooperative creameries pasteurization is not practiced very much -- only here and there.

MR. POWELL: In what way can you extend the butter problem to make it have a wider range, provided you had money to do it; that is, what are the lines where the butter problem might be extended that will make it more far-reaching than it is at the present time?

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MR. ROBERTS: Do you want to, as will say, with the
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MR. ROBERTS: A great deal of our butter, of course,
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MR. ROBERTS: In what way can you extend the butter
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...then it is at the present time?

MR. ROGERS: We are just beginning on a very small scale investigations looking toward the improvement of butter making on the farm. Of course, we know how to make butter on the farm, but what we want to get at is how to make the farmer make better butter, and that will include not only the question of care of milk for making butter, but methods of transporting that butter, packing it, handling at the market, and everything of that kind. We also could do something more nearly demonstration work in the method of buying and storing butter on a commercial scale; that is, I believe, if the men who handle butter (some of the big commission houses and even the retailers) should adopt a method of buying butter similar to that used by the Navy Department, for instance, they could get a very much better quality of storage butter.

MR. POWELL: What is that?

MR. ROGERS: Navy butter is bought under contract; that is, the Navy Department contracts for butter to be made under their direction, or under the supervision of an inspector, and the butter is paid for on a sliding scale, depending on some market, usually New York. Then this butter is checked up and inspected. This butter is made by any method we prescribe. It is made under the supervision of the Dairy Division. A man can under those conditions include in his contract certain specifications for the quality of the cream and the method under which

butter is made. That, I say, is more nearly demonstration work because we feel reasonably sure of what we can do with it.

MR. RAWL: Just one word in that connection. In regard to the question you asked a moment ago as to the necessity for a study of the handling of these problems, it is rather to be regretted that we have to say that the great complication in the whole question of butter making is not primarily due to lack of knowledge of how to do these things, but to a lack of knowledge of how to do them under existing circumstances. When we had the creamery with fifty or sixty patrons living around it and bringing in their milk fresh every morning, if the milk was produced reasonably well and delivered to the creamery in a few hours after it was drawn, why any intelligent butter maker could make a very high grade of butter and had been able to do that for many years, but that kind of a creamery is almost obliterated. Now we have hand separators and big central plants that collect their cream from a radius of hundreds of miles, and that brings in an enormous number of problems, one of which is how to make a reasonably good product out of inferior raw material. The large plant and the hand separator are here to stay, and we don't blame the farmer, but you can see readily that this question of storage that Mr. Rogers has been discussing here is dependent on the ability to utilize ordinarily

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good raw material which we have where most of this work is done. I suppose the raw material of what is known as the cooperative plant is about average. A good portion of it is whole milk brought in daily. That perhaps might be considered above the average, but it is a question of establishing cream routes whereby you can force these farmers to get their cream into the station or creamery at the proper time. It is a question of handling their barns and having sufficient equipment to clean up their utensils. That question is one of the most phenomenal sources of contamination that you can imagine, and you would be surprised to see how many think that the separator does not need to be washed because the cream is sold. The separator is washed perhaps once or twice a week. It is a source of the most vile contamination. We know how the problem ought to be handled. If you can take a herd of cows and keep them clean and use clean vessels and get the milk from healthy cows, the butter maker will do the rest and will put butter on the market that will satisfy all demands. But how are you going to educate these two millions of farmers in the United States who produce this raw material? There is the big problem of the whole butter industry.

MR. POWELL: It is not organized like some other industries?

MR. RAWL: It is not organized, and here are the cooperative and the big central plants operated on different

systems. Unfortunately, the grade of butter has been going downward and downward and downward, notwithstanding that we know more about butter now than we did five years ago.

MR. TAYLOR: Has it been going down with the cooperative creamery?

MR. RAWL: Steadily going down.

MR. ROGERS: I think it has.

MR. RAWL: You will find it is lower today than it was five years ago. There exists a condition that is rather unusual, I think. These big central plants, according to their present methods, can buy cream all over the country. At Omaha there are twelve or thirteen big plants, some of them producing more than 100,000 pounds of butter a day. They draw their supply from Kansas, Nebraska, Colorado, Iowa, and other States. A large part of their material comes four, five or six hundred miles. The competition is so strong that it is simply a case of "If you don't take my stuff, here's a man who will."

DR. STILES: Are the remarks you make in regard to the butter problem applicable to the milk problem?

MR. RAWL: They are applicable to the whole dairy industry. Take Swiss cheese, for example. In the winter time they shut down. The winter is in some ways rather conducive of bad methods. As you know, it is the season in which they have to care for their cows, and it is a

season that requires a great deal of labor to produce clean milk. That perhaps is not the only governing factor, but the fact remains that in the winter time the cheese factory is shut down. This is not the case with butter. You can make some kind of butter out of almost any kind of cream, as has already been explained. It is really wonderful to see the grade of butter that is being made through high pasteurization. It is unfortunate, and it seems to me it is going to carry the industry downward, to have so much material that might as well be first-class material if it was handled properly go into the market in this way. But the public is willing to accept it. A great many people are eating oleomargarine who don't know the difference. They are eating and paying butter prices for what is really oleomargarine. It is an enormous problem to work out - not scientifically, however. The scientific end is not the most perplexing, but the great problem is in applying the scientific knowledge that we have to the getting of the material to the creamery within the first six, eight, or ten hours, instead of two or three days after milking, and getting it there in such condition as to make a first-class product.

PROF. COMBETT: Those are the great problems of our work today -- to get matters before the people. They are not questions so much of investigation as they are great economic questions that we are up against today. That is

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the way it appeals to me.

MR. RAWL: No doubt of it.

MR. TAYLOR: Is the cooperative creamery which is making good butter able to compete with the central plant that is making poor butter?

MR. RAWL: They are able to compete very satisfactorily, but the whole trouble is that so many of the cooperative creameries are not making good butter. The big creamery employs the best skill that the world affords. It pays the man in charge \$6000 or \$7000 a year. But a cooperative creamery pays perhaps \$100 a month for a man who can make a first-class product. Another butter maker offers to make butter at \$50 a month and the patrons of the creamery do not seem to appreciate the difference between the two and say there is no sense in paying one man \$100 a month when we can get another to do the work for \$50, while, as a matter of fact, the \$100 man will probably earn for them a great deal more than the difference in the salary. It is an enormous educational problem. The creamery goes up or down in proportion to the ability of the butter maker. The good butter maker goes out and educates the patrons. He gets their moral support. He says "We can't make good butter out of this stuff; you must make it better, and you must make it better in such and such ways," and in this way conditions are improved. Another man pays no attention to the quality of his raw

material and his creamery goes down and down when brought in competition with the big creamery that has the best skill on earth that money can employ.

MR. POWELL: Are there any more questions on the butter problem? This is one of the most interesting problems in the Department that comes under the so-called transportation and storage work. I think it is one of the most complicated and far-reaching and one of the most difficult to investigate, yet one of the most useful problems to take hold of. I have never heard a better exposition of some of the difficulties than Mr. Rogers and Mr. Rawl have given.

There are some other interesting problems in the Bureau of Animal Industry which have been considered more or less, and one of the most interesting of these is the question of egg handling and the relation of egg handling to the storage and transportation side. The Bureau of Animal Industry has given some consideration to these problems. Mr. Rommel will give us some idea of how they look at the problem from their side.

MR. ROMMEL: I will endeavor to be very brief, because I have not much to say. We have simply made a preliminary survey of this subject and have made a study of the production of eggs on the farm and their relation to the market, principally from the standpoint of their deterioration in handling. This has been found to be a

very appreciable amount. We have estimated that the loss in the value of the egg crop each year is about 17 per cent of the total valuation, 2 per cent of which is due to breakage, and about one-half of 1 per cent is due perhaps to loss on account of being stored in musty cellars or storage rooms with bad ventilation or containing decaying vegetable products or something of that kind. It may be said in round numbers that 15 per cent of our total egg crop each year is lost on account of bad methods of handling before the eggs get into storage or into the general market. The loss is due to the shrinkage of the egg, to evaporation, to chick development, to spoiling, and similar causes, all of which can be traced back primarily to the small country store and to the farmer himself. That is as far as we have carried our work up to the present time. What we have in mind is the development of some lines of investigation that will enable us to show to the farmer or producer of the eggs just exactly what he shares in this loss. The total amount is tremendous. Three hundred million dollars is a conservative estimate of the value of the annual egg production in the country. It is probably considerably more than that, but, using that as a basis, this bad handling of eggs represents a loss of at least \$45,000,000 a year to the farmers of the country, because it is the farmer ultimately who bears this loss, simply because the man who buys those

eggs from him is unable to pay him a higher price for the eggs. A line of action with the farmers might be taken up and through agencies that come closely in touch with them, such, for example, as the local creameries, where the eggs can be bought on a basis of merit. I would like to see the Department representatives handling eggs that come in to creameries as we have heard that the fruit in California was handled; that is, let Department men who are entirely unprejudiced candle those eggs when they come in and grade them. Let that shipment be followed through to destination and have the farmer paid exactly what those eggs are worth; that is to say, let them get for the good eggs a good price and for the poor eggs no more than they are worth. It means a great deal, not only to the farmer but to the entire country. For example, eggs are now selling at 15 cents a dozen in the South that are first-rate eggs and they are fresh, but, if those eggs are sent North they go into the class known as "Southern eggs," and that is just about as bad a thing as could happen to them, as the Southern egg has a horrible reputation on the market. Yet the difficulty is primarily that the farmer does not know how to take care of those eggs and does not know that the egg that is soiled won't keep as well as the one that is clean, and he does not know that the country cross-roads storekeeper man puts them back of the stove for a week before he is ready to send them to the commission house,

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which causes further deterioration. That is about all I have in mind right now. Of course, along the same line as egg handling comes the handling of poultry on the farm, preparation for shipment, killing, etc. That in itself is a tremendous field and one that we have not yet gone into to any great extent.

MR. POWELL: It seems to me that you have a magnificent problem for investigation and demonstration, one that ought to have every influence brought to bear upon it to develop better facilities for conducting the work in a comprehensive way, so that you can put your own corps of men in the field to conduct comparative experiments to bring out the effect on their quality of the handling of eggs on the farm. It is a problem that needs very extensive field investigations supplemented by very critical laboratory studies.

MR. ROMMEL: I think the egg situation is comparable somewhat to the citrus fruit industry, and, while we may say we have a loss of perhaps \$45,000,000 a year in the egg trade, it is a loss to the farmer because the farmer does not get for his eggs what he might get for them if they were properly handled, and, if he got that \$45,000,000, it would not necessarily come out of the consumer's pocket, simply because the consumption price would be less on account of the greater production of high-priced eggs.

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sive study and investigation by your university
laboratory studies.

MR. POWELL: I think you are absolutely right. It is
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the trade, it is a loss to the farmer because the farmer
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slightly lowering the competition price would be less on ac-
count of the greater production of high-class eggs.

DR. DUVEL: If the consumption was less, the price would have to go down.

MR. ROMMEL: The point is this: the price could go down and at the same time most of that \$45,000,000 would be saved to the farmer. You know perfectly well that one reason why there is not a larger consumption of eggs is that the average person has good reason for not eating eggs. If he felt sure he could get a good one, he would eat one every morning.

MR. RAWL: Most of them eat them anyway.

MR. POWELL: I am interested in the egg problem from the departmental standpoint. I am interested in it in seeing the opportunity that it gives us to make a careful systematic investigation in the field of the facts and principles which must be used as a basis to promote your educational work. Now it seems to me that those are the things in connection with which a committee of this type could be helpful. It can bring to bear all the influence possible to have these lines developed. They are sound lines, both from the standpoint of the industry and sound investigational lines from the standpoint of the Department. Are there any observations to be brought out along this line?

MR. RAWL: I think not at the present time.

MR. ROMMEL: I think not.

MR. POWELL: In the Bureau of Chemistry there is

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way. Are there any observations to be brought out along

in line?

Mr. HAWK: I think not at the present time.

Mr. ROBERT: I think not.

Mr. ROBERT: In the Bureau of Chemistry there is

being developed quite a good deal of investigation on problems that relate to transportation and storage. Dr. Stiles has been working on oysters and other products; Dr. Pennington has been working on poultry and has done a great deal of laboratory work on the storage side of the question. We would now be very glad to hear from Dr. Pennington on the lines of work developed in her investigations in the Bureau of Chemistry.

DR. PENNINGTON: Suppose I begin with poultry, because, while we have worked the egg and poultry problems together, it was really the poultry problem that set the pace for the egg problem. In the first place, the project which we have in entitled "Investigation of the handling of poultry intended for food." It developed from the storage work that was begun some years ago in the Bureau of Chemistry. We found in doing the work on cold storage poultry that there was a previous history which had to be reckoned with and that there was a subsequent history which was of very great importance to the consumer. So we stopped working in the storage houses exclusively. We had developed some facts that were interesting from a scientific viewpoint and were a basis for practical work. When that idea dawned upon us, it carried with it, of course, the realization that it was a commercial as well as a scientific problem that we had on hand. We were also quite certain that the dressing of a few chickens under

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experimental conditions, handled in an experimental fashion, stored in an experimental way, and sold as an experiment, was interesting as an experiment but was not going to be of very much value, either to the industry or to the consumer. Therefore, we had to go back and get in touch with the industry. It was necessary that we should cooperate with the industry, and the industry was afraid of us; they did not know what we were going to do. I went personally first to the Warehousemen's Association and told them what we wanted to do. They were more than willing to help just as soon as they understood the basis of our work and desires. In them the Department has a factor which has much influence both at the beginning and at the end of the poultry problem, because they stand in the middle, as it were, of the poultry and egg industry, receiving from the packer on the one hand the products that he prepares and distributing to disbursing agents, on the other hand, the products that are stored. It is of interest, too, because the warehouseman frequently loans considerable sums on the products which are stored. Therefore, he has a good deal of influence upon the quality of the material coming into his warehouse and on the selling of the material from the warehouse. The warehousemen introduced us to some of the influential poultry packers, that is, to a few. It was not necessary to introduce us to more than a few, because our work was taken

up by the packers in the same spirit that it was taken up by the warehousemen. When they knew what we wanted, they were more than willing to help us. Then came the railroads, and there the work of the Bureau of Plant Industry had prepared the way for us, so that it has been most delightfully smooth. The railroads have been willing to do anything they possibly could to help our work. One railroad has revised its accounting system, so far as poultry is concerned, in order to get certain information we want in regard to the claims question, and that, as you know, is one of the most delicate questions that one can take up with a railroad. They are also willing to give us any information we want, whether it is information usually furnished to the trade or not. They apparently have entire confidence in the discretion of the Department that the information furnished shall be used for the industry and not for any undesirable purpose. Then came the commission men, and right here everybody said to us "The packers may have helped you and the railroads, because it is to their advantage to do so, but when you come to the commission men you will have difficulty." But the commission men fell in line just as easily as everybody else, and they have rather vied with the packer and the railroad in doing all they can to help us, particularly in New York where perhaps it was least to be expected that we would find co-operation. So the problem of harmonious relations in the

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industry was settled. Then came the planning of the work and the elucidation of the questions which were most important in the good handling and keeping of poultry. We found that the laboratory side and the field side were inseparable. One was absolutely dependent upon the other. In the storage work we had previously found that, unless we had the pre-storage history, the work in the laboratory, chemically, histologically, or bacteriologically, was of no use. In our field work many of the observations had to be referred to the laboratory in order to make them intelligible. Then came another question, and that was the decision as to when decomposition in the sense of good keeping began, because we found from our final results that decomposition must have started before indications from odor, taste, or texture -- the usual methods of detecting it -- were observable. Therefore, laboratory methods had to be worked out, whereby these beginnings of decomposition could be determined, and those we have been working on and we have a number now that are available. We find them of inestimable value; indeed, we can not do anything in the field without the laboratory to help us along. Now as to the conditions in the packing houses: we are trying to trace every step in the whole poultry problem, from the time the chicken is picked up to be killed until it is finally delivered to the consumer. That means, first, a study of methods of killing, and the

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keeping quality depends very largely on how that chicken is killed. For instance, we have string killing and bench killing and a combination of string and bench. All of those methods we must work out so far as their advantages or disadvantages are concerned. We have, too, scalding and dry picking. It means all the difference in the world in the keeping quality which way the feathers are taken off. Then we have a study of the removal of the animal heat by dry cool air or by water, and finally packing in ice. That is one of the very biggest of the problems. Before that I should have mentioned the problem of drawn vs. undrawn poultry as a market practice. In fact, there is nothing that is done to the poultry in the packing house that does not have ultimately some bearing on its keeping quality and its grade; I mean, of course, insofar as the keeping quality is concerned -- not the amount of fat, or the size of the chicken, whether it be a large roaster or a tender spring broiler. I have been surprised to find that that side of the question is not so important as one would ordinarily suppose. It is a good chicken that is wanted in the market -- a chicken that is well prepared and well kept, and I personally would rather have a hen that is properly picked and handled, so far as flavor is concerned, than the nicest broiler ever grown which has not been properly dressed nor kept. We have also had organoleptic tests of these birds prepared in different ways at the packing houses and at points of consumption.

We are making experiments, both bacteriologically and chemically, to determine the condition of the birds when they leave the house. On the railroads transporting those birds to their second destination, which is ordinarily not the last, we have thermographs and we have a complete record of temperatures. The railroads are helping us just as far as they possibly can. We load just as is done in the fruit transportation work, having different packages of known contents in different parts of the car. We find that there are great differences in the carrying quality according to the part of a car in which the material is loaded, whether it is on the bottom next to the bunker or whether in the middle or half-way up in the car. We find a difference due to the kind of refrigerator car used. All of this information, of course, is eagerly sought by the railroad, and that has been one of the reasons they have been so anxious to help us. When the material is received at the warehouse it is inspected in the ordinary fashion, and we are keeping careful records of every detail of the conditions observed. If the warehouse does not have trackage, note is taken of the time consumed in transferring the product from the car to the house, also of the temperatures. Notice is taken of the condition in which the birds arrive. This is done not only by visual inspection but the contents of some of the boxes are taken to the laboratory, where we can go

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is mainly bought by the railroad, and that has been one of
the reasons why we have been unable to sell our birds.
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of the house are found to be satisfactory, when we find

further than eyes or noses can carry us. From the warehouse those products go ordinarily to the commission merchant and we follow them into his hands. The same routine is gone through there -- ordinary inspection and laboratory examination. So you see that every stage in the history of the poultry is followed. If it is advisable, we remove samples for longer storage or for special experimentation. We always ship our own experimental packages and packages which have been prepared commercially side by side. That, I think, has been the custom also in the fruit work. In this way, we can check one against the other, so that we may know from the comparison what advantages there are, if any, to the industry by the use of special methods, and we can show the industry what they are doing, thus killing two birds with one stone. The financial problem has been a great one, because poultry is very expensive. We have therefore arranged with the packer that we shall pay for those specimens that are taken to the laboratory and completely used. We, however, have the privilege of inspecting any number of boxes in the car that we desire. We generally tag about 20 to 25 boxes, occasionally 50, with red, white and blue tags. The lack of a knowledge of English on the part of many people handling these products has made it necessary to have some sort of a sign which will mean that those boxes are not to be tampered with, not to be opened or sold

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until the men in the field who are doing this work have had a chance at them. Therefore, loaders and unloaders will pile those boxes together, their thermographs with them, and they have learned to handle them very carefully and well, and the boxes are generally known as "that red, white and blue stuff." The boxes that we simply inspect are put into as good shape as possible and are sold with the other material, and so far there has been absolutely no friction between the packers, commission men and our own people with regard to inspection of the product, either in the warehouse or at the terminal points.

Now as to eggs, they follow largely the same lines as poultry. The eggs come into the packing house and we have endeavored as far as possible to see how they are brought in -- whether they come in in baskets or in egg boxes, whether by railroad or by wagon, and whether they come in large lots from country stores or in small lots from the producer. We have tried to see how those eggs candle out in the beginning. We have looked at the facilities in the packing houses for the storage of the eggs while there and the condition of the eggs when they are shipped out, whether pre-cooled or warm. We have also looked at the quality of eggs in different parts of the country, as we have gone about from packing house to packing house. The Southern eggs, for instance, we have tried to compare with Northern eggs, where they were supposedly of about the same age and probably just about as badly

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handled in one place as in the other. Then we have traced these with reference to destination and have examined them according to their candling qualities generally and their taste. We don't bother to poach them or cook them; we taste them raw to determine the flavor. Sometimes it is very close to eating them alive, too. It takes a great deal of scientific zeal and enthusiasm to taste those eggs. Then, as to the investigation of storage eggs, we have some very interesting results, and I hope to be able to correlate those with the general handling proposition. We are going to get the storage data in the next few months if the whole series of experiments turn out as the earlier results indicate. That will really give us some basis to figure out the commercial returns for the storing of large, clean, fresh eggs as compared with small, dirty, badly handled eggs that so often come to the warehouses. There is, of course, an enormous amount of work to be done in the planning of both these investigations, but so far as they have gone it seems to us that the returns to the consumer and to the industry would warrant pushing them.

MR. POWELL: This is a very interesting series of problems that Dr. Pennington has been working on. I was especially interested in seeing how she started back at the foundation and has worked up fundamental facts and principles connected with the handling of these products from the producer to the consumer. Another interesting

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fact is that it brings out the organization of the laboratory and field work around the problem. A good deal of our work loses force by having some of it scattered in one part of the Bureau and some in another part and through lack of cooperation and coordination of the work in a particular Bureau. Dr. Pennington has organized her laboratory force and her field force so that one is constantly supplementing the other. She has a long-range problem and is making all of the results of these investigations dovetail into the general poultry problem. I was interested also in seeing that there are a great many points of contact in the last line of work between the Bureau of Animal Industry and the Bureau of Chemistry which might very profitably be considered further with a view to enlarging and making more effective the work of the Department as a whole.

DR. PENNINGTON: It seems to me, using one of these creameries as a basis for cooperation, it would be almost ideal.

MR. RAWL: The difference Dr. Pennington refers to in the quality of eggs would involve a tremendous breeding problem, going right back to the breeding end of the business.

PROF. CORBETT: And to the feeding end.

MR. RAWL: Yes.

MR. ROMMEL: Southern eggs as a class are inferior

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DR. FRANKLIN: And to the feeding end.

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to Northern eggs.

DR. PENNINGTON: They are usually smaller and thinner and have to be stored at a higher temperature.

MR. POWELL: Just like butter. The worst butter has to be stored at a lower temperature.

DR. PENNINGTON: It is just the reverse. The worst eggs are stored at the higher temperature. We can store Northern eggs at 29 degrees, but we can't store our Southern eggs below 30. The water of the egg will evaporate more rapidly from a thin-shelled egg than from a thick-shelled one.

MR. TAYLOR: Do these eggs stored at higher temperatures keep as long as the eggs stored at lower temperatures?

DR. PENNINGTON: No, thin eggs do not keep as long as thick eggs.

PROF. CORBETT: Would not the character of the soil in the different localities have some effect on the eggs?

DR. PENNINGTON: I have never been able to correlate any relation.

MR. SLOCUM: It is more a characteristic of the individual hen, it has always seemed to me. One hen would produce a firm-shelled egg and another hen a weak-shelled egg.

PROF. CORBETT: How would you account for eggs of the South being thinner?

MR. SLOCUM: I don't think you could correlate the soil conditions.

PROF. CORBETT: I was wondering whether in sandy regions and regions devoid of calcareous matter the tendency would be to produce thinner-shelled eggs.

MR. SLOCUM: That might make a difference.

DR. PENNINGTON: I fear I did not make myself clear when I said "thin" eggs. I meant the consistency of the contents -- the white and the yolk, and not the shell.

MR. POWELL: Are there any more questions relating to the general plan and policy of the Bureaus in work of this kind? If not, I would suggest that we come together again for an hour at 2 o'clock. There are several lines that ought to be presented. I think some of us may have wondered for the first couple of hours how a discussion of this kind could be beneficial to the different people engaged in storage and transportation investigations, but as the discussion has continued, many points have arisen that will doubtless be exceedingly helpful in developing future lines of work.

(At this point the conference adjourned for lunch, the Chairman stating that the discussion of other lines of the work would be resumed at 2 p.m.).

MR. THOMAS: I don't think you could confuse the

with anything else.

MR. THOMAS: I am assuming that in some way

there are regions devoid of economic matter in tendency

to be in some way related to the

MR. THOMAS: That might make a difference.

DR. THOMAS: I am I did not make myself clear

when I said "thin" again. I meant the consistency of the

regions -- the white and the black, and not the middle.

MR. THOMAS: I am assuming that in some way

in the future there will be some kind of

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again for an hour at 2 o'clock. There are several things

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of this kind could be beneficial to the different people

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future lines of work.

(At this point the discussion of the day was closed.)

The chairman stating that the discussion of other lines

of work would be resumed at 2 p.m.).

Afternoon Session, January 13, 1910.

The conference reconvened at 2:15 o'clock.

MR. POWELL: Are there any more questions to come up on the poultry and egg discussion that we left just as we were going to lunch?

MR. SHANAHAN: I would like to ask Dr. Pennington what section of the country she is working in and how extensive a territory she is covering in her work.

DR. PENNINGTON: From southern Missouri to northern Iowa, middle Ohio to Nebraska, and southwestern Kansas. You see the poultry belt and the corn belt are almost coincident.

MR. DOWNING: The bulk of the eggs that are sent to market or put into cold storage are raised on the farms of the Middle West, are they not?

DR. PENNINGTON: Just what do you mean by the Middle West?

MR. DOWNING: The Mississippi Valley.

DR. PENNINGTON: Yes, through the Mississippi Valley. Oklahoma is about the most southern point for any large number of eggs. The Michigan eggs are good eggs but they are not in very great quantity. The season is too short.

MR. DOWNING: Are not Nebraska and Kansas included in the belt?

DR. PENNINGTON: Yes, eastern Nebraska.

MR. DOWNING: Kansas is a very productive State.

THE GREAT PLAINS

Q. Now, the first thing I want to ask you is, what is the general character of the country in this section of the country? Is it mostly flat, or is it hilly? Is it mostly open, or is it wooded? Is it mostly dry, or is it mostly wet?

A. Yes, sir. The country is mostly flat, and it is mostly open. It is mostly dry, and it is mostly wooded. It is mostly hilly, and it is mostly wet.

Q. Now, the second thing I want to ask you is, what is the general character of the country in this section of the country? Is it mostly flat, or is it hilly? Is it mostly open, or is it wooded? Is it mostly dry, or is it mostly wet?

A. Yes, sir. The country is mostly flat, and it is mostly open. It is mostly dry, and it is mostly wooded. It is mostly hilly, and it is mostly wet.

Q. Now, the third thing I want to ask you is, what is the general character of the country in this section of the country? Is it mostly flat, or is it hilly? Is it mostly open, or is it wooded? Is it mostly dry, or is it mostly wet?

A. Yes, sir. The country is mostly flat, and it is mostly open. It is mostly dry, and it is mostly wooded. It is mostly hilly, and it is mostly wet.

Q. Now, the fourth thing I want to ask you is, what is the general character of the country in this section of the country? Is it mostly flat, or is it hilly? Is it mostly open, or is it wooded? Is it mostly dry, or is it mostly wet?

A. Yes, sir. The country is mostly flat, and it is mostly open. It is mostly dry, and it is mostly wooded. It is mostly hilly, and it is mostly wet.

DR. PENNINGTON: Kansas, Iowa, Illinois, and Ohio.

MR. POWELL: Do you run up into Minnesota and Wisconsin?

DR. PENNINGTON: Yes, but the season is short up there for eggs and poultry. Those are our latest fresh eggs.

MR. POWELL: The poultry belt follows the strawberry belt.

DR. PENNINGTON: Just about.

MR. DOWNING: I want to ask the Doctor if she thinks the Danish cooperative method is applicable to our situation here, with respect to improving our present method of marketing eggs.

DR. PENNINGTON: I think we would need a lot of education before we could use the Danish method. It certainly would improve matters if we could use it.

PROP. CORBETT: We would have to have their district supervision before adopting their marketing methods.

DR. PENNINGTON: Yes, and that would mean education all along the line.

DR. STILES: As a matter of fact, the final solution of many of these problems is education as to the source of production.

MR. POWELL: That is true.

DR. STILES: There is one little phase of the egg

MR. DOWNING: I think, yes, I think, yes.

MR. DOWNING: Do you run up into Minnesota and Wis-

consin?

MR. DOWNING: Yes, but the reason is about up

about the same, I think, as the reason for the

MR. DOWNING: The primary belt follows the secondary

belt.

MR. DOWNING: Just about.

MR. DOWNING: I want to ask the Doctor if he thinks

the Finnish cooperative method is applicable to our situa-

tion here, with respect to improving our present method

of instruction.

MR. DOWNING: I think we would need a lot of edu-

cation before we could use the Finnish method. It certainly

it would improve matters if we could use it.

MR. DOWNING: We would have to have their kind of

education before we could use their method.

MR. DOWNING: Yes, and that would mean education

all around the line.

MR. DOWNING: As a matter of fact, the first solution

of many of these problems is education as to the source

of the problem.

MR. DOWNING: That is true.

MR. DOWNING: There is no little about it.

production problem that we have to deal with in connection with interstate shipments of eggs under the Pure Food Act. This relates more particularly to frozen or liquid eggs. We have recently brought a number of cases against concerns shipping an inferior quality of eggs which were undoubtedly in this state when put in cold storage or frozen. These eggs are used largely by bakers or confectioners, and the handling of this perishable product is quite an item in itself. In some of our local bakeries, in fact in any large city, you will find 50 pounds of eggs which may have to stand around a bakery before they are used, and in the summer time the product is in a much worse condition after being in the bakery a few days than it was in storage. The terminal phase of the transportation problem is important here.

MR. POWELL: I think there is an opportunity here for a pretty extensive study of that side of almost all of these questions. I think the condition of the product after it reaches the market -- after it goes out of the warehouse and before it goes into use -- is an important thing to consider. In our fruit work we have made that quite a phase in studying the keeping quality. We find that the oranges on the New York market exhibit the widest differences in their keeping qualities, depending upon the way in which they have been handled. There is need of work of this type. It needs to be followed more closely

correlated with the general problem. This work has received very little attention in most of the studies of perishable products thus far.

MR. TAYLOR: Dr. Stiles, do I understand that the egg label, that is, the canned egg label, would have to change with the changing condition of the contents of the cans?

DR. STILES: I hardly understand the question.

MR. TAYLOR: For instance, if the eggs were of a certain character and so labeled when frozen; does that label have to be changed as the eggs deteriorate?

DR. STILES: So far as the Pure Food Act is concerned, we find that a large percentage of the liquid, frozen, and desiccated egg business is built up, you might say, on the refuse of the regular industry, mostly taking the cracked and various inferior grades of eggs, from the questionable sort down to the distinctly ancient variety, desiccating them and putting them in cold storage for a variable length of time, and, when they get hold of them in interstate commerce samples, they may be in very bad condition.

MR. TAYLOR: The question, then, is rather one of wholesomeness than of flavor.

DR. STILES: In further answer to your question, if they are labeled for technical uses, that eliminates the food part. They are using these extremely bad eggs for

continued with the same quality. This was the first

very little attention is paid to the quality of

these products from the

Mr. TAYLOR: Dr. Miller, do I understand that the

label, that is, the canned egg label, would have to

be changed to the present one and that it is not

possible

Mr. Miller: I don't understand the question

Mr. TAYLOR: For instance, if the eggs were of a

certain standard and we found that they were not

label have to be changed as the eggs deteriorate?

Mr. Miller: So far as the Pure Food Act is concerned

it is not a large percentage of the liquid, frozen,

and dehydrated egg business is built up, you might say,

on the value of the eggs. However, during the war

cracked and various inferior grades of eggs, from the

market and from the different sources, were

being put in and putting them in cold storage for a

while and then they were sold in the

in interstate commerce cases, they may be in very bad

condition.

Mr. TAYLOR: The question is, is it not possible

to have a standard of quality?

Mr. Miller: In answer to your question, if

they are labeled for inspection, that is, if

they are using these extremely bad eggs for

tanning purposes, but some of them that are labeled for tanning use actually get into food consumption channels.

MR. DOWNING: Don't they use some of them in the book-binding business, too?

DR. STILES: Such industries as that, yes.

MR. POWELL: I have a distinct recollection of going through one of those factories last summer. The thermometer was 104 out of doors and 120 in the factory where these bad eggs were being put up.

DR. STILES: The normally fresh egg has few, if any, organisms. We have found as high as 2,000,000,000 organisms per gram in the desiccated product. You can imagine how far decomposition has taken place in such material.

MR. POWELL: There is quite a little more work that has been done by the Bureau of Chemistry, and we will be very glad to hear from Dr. Stiles on the oyster work.

DR. STILES: The main line of our investigation has been in connection with the oyster industry. I intended to ask this morning something about the fig industry. We have done considerable work along that line and in connection with other dried fruits. The gentlemen interested in corn investigations would be interested to know that we have found some samples of cornmeal that are of questionable purity so far as the bacterial standpoint is concerned -- especially now that the pellegra disease is

... but some of them that are in the
... are actually not in the food consumption
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... food-binding business, food

MR. STILES: That industry as food,
MR. STILES: I have a distinct recollection of seeing

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... were being put up.

MR. STILES: The factory there was not, it was
... We have found as high as \$2,000,000 of pro-
... in the domestic market. You can imagine
... has taken place in such manner.

MR. STILES: There is quite a little work that
... and we will be
... led to hear from Mr. Stiles as the work.

MR. STILES: The main line of our investigation has
... in connection with the export industry. I intended
... ask this morning something about that industry. We
... have done considerable work about it and it has
... with other details. The government is

... is even interested in it and is interested to know
... that we have found some samples of cornmeal that are of
... as far as the industrial standpoint is
... -- especially now that the business is

rampant among us -- and the relation it bears to the public health. Those problems are only in their infancy so far as the prosecution of the Pure Food and Drug Act is concerned. However, the main subject we have had to deal with in our phase of the work is the oyster industry.

Some two or three years ago a delegation from the North American Oyster Growers' and Dealers' Association called upon Dr. Wiley to ask for his assistance in helping them regulate the oyster industry. As a matter of fact, they wanted Dr. Wiley to investigate and substantiate or disprove the claims that were being made through the interior of the country that bad oysters were being shipped throughout the Western States. They were the subject of newspaper comment and the oyster dealers and growers were suffering from these reports, especially from the newspaper statements. So we took up investigation from various standpoints, more particularly along the line of different methods of shipping oysters, and for that purpose those of us who were working on the investigations went to the seaport towns. We selected four different points -- New Haven, as representing one section, the northern, New England, section; the eastern end of Long Island (Patchogue was the town); we went also to Norfolk and made shipments from there, and we also made shipments from Biloxi, Mississippi. In carrying on these investigations we went out first to the oyster growers or planters

important work in the field of the oyster industry in the United States. Their mission was to study the oyster industry in the United States and to report on the results of their work.

However, the main subject we have had to deal with is the oyster industry in the United States.

Some two or three years ago a delegation from the United States Oyster Growers' and Dealers' Association visited upon Dr. Wiley to ask for his assistance in helping them to study the oyster industry in the United States.

First, they wanted Dr. Wiley to investigate and establish the facts or disprove the claims that were being made through the interior of the country that had oysters were being shipped throughout the Western States. They were the

subject of newspaper comment and the oyster dealers and growers were suffering from these reports, especially from the newspaper statements. So we took an investigation of the oyster industry, more particularly along the line of the different methods of shipping oysters, and for that

purpose those of us who were working on the investigation went to the oyster industry in the United States and to the oyster industry in the United States.

First, we went to the oyster industry in the United States, and we also made shipments from there, and we also made shipments from there, and we also made shipments from there.

Second, we went out first to the oyster growers or dealers

and enlisted their assistance in every way we could. We first had to secure their cooperation in order to gain the points we were seeking and, in order to do that, we hired their boats and went out on their oyster beds with them during these trips. While securing samples of oysters and water for bacteriological and chemical investigations, we gleaned from the men, from the crews of the boats, and from any source we could, all the points we could possibly get concerning the industry at large. By coming intimately into contact with the oyster growers and with the men who manned the boats and so on, we were able to gather a large amount of valuable data. In other words, we endeavored to cover the field so as to learn as far as possible the absolute history of the conditions at source which would in any way affect the samples with which we were working. For instance, take one illustration. With one or two inspectors we would go out on the boats and harvest from twenty-five to fifty bushels of oysters in the shell. We were present on the boats when these oysters were dredged or tonged from their beds, and method varying according to locality. Different States have different laws regulating the methods of taking the oysters. It is against the law in some localities to dredge at certain seasons of the year and oysters have to be taken with tongs only. We were governed by the laws or customs in the different lo-

and adjusted their assistance in every way we could. We
it was not to secure their cooperation in any way
points we were seeking and, in order to do that, we hired
their boats and went out on their oyster beds with them
having some light, white canvas awnings on the boats and
before for bacteriological and chemical investigations, we
glanced from the men, from the oars of the boats, and from
any source we could, all the points we could possibly get
concerning the disease of oysters. We made this
into contact with the oyster growers and with the men who
worked the boats and so on, we were able to gather a large
amount of valuable facts. In other words, we endeavored to
cover the field as far as possible the ap-
parent history of the disease as far as we could get it
any way affect the oysters with which we were working. For
instance, the first investigation, we had to be in-
sore we would go out on the boats and harvest from twenty-
five to fifty bushels of oysters in the shell. We were
present on the boats when these oysters were dredged or
found from their beds and noted every specimen
collected. Histories of the disease from oyster
the methods of taking the oysters. It is against the law
is now forbidden to dredge at certain seasons of the
year and oysters are to be taken with shells only. The
are governed by the law or custom in the different lo-

calities. We secured our samples, saw them taken from their beds and placed in the boats. We also took samples of water -- in some localities deep samples of water and surface samples -- to determine the question of pollution and salinity of the water where the oysters were growing. These results were kept in connection with the investigation of the oyster industry itself. So far as the oysters were concerned, they were treated according to the local custom. For instance, down at Biloxi, Mississippi, the oysters grew exceedingly large, similar to tropical and semitropical plants. Oysters down there, for instance, which are three years old would be equal to those five or six years old grown in the North, in size and contents of the shell. Some of the Southern oyster shells are eight to twelve inches long. The three-year-old oysters were longer but did not have the depth of body as did the Northern oysters, simply showing the difference in conditions. We would take these oysters, hire the regular shuckers at an oyster establishment to shuck the oysters for us and we would treat these oysters in various ways. In a general way, we treated them somewhat after the following manner: In taking the samples we were governed by the local conditions. We would have these oysters shucked and one portion we would not wash at all. For instance, we would take six gallons of shucked oysters and divide

them into two samples. Three gallons would go into a can in which the ice was packed around the sample and the other three gallons we would put in a can in which, according to the customary method in that locality, a chunk of ice would be put in contact with the oysters. That would constitute samples A and B. Samples C and D we would treat in a similar manner except that the oysters had a preliminary washing of, say, thirty minutes. This washing they claimed was necessary to remove filth, bits of shell, sand or debris, etc. We would then treat a further set of samples, varying the lengths of time of washing according to local custom. I might say it was customary in certain localities to soak their oysters in fresh water after they have been shucked. In some instances, this water is running water. This soaking process enables the oyster, by a process of osmosis, to increase in bulk anywhere from ten to twenty-five per cent in volume. An incident which happened will illustrate this point very aptly. At one of the points of shipment we took six gallons of oysters one evening that had not been treated in any manner, that is, right off the boat from water of reasonable salinity. We drained the excess of liquor off of them and they were placed in a porcelain bath-tub which had not been previously used except for soaking oysters. We measured the oysters accurately, placed them in the tub, and filled the tub about one-

from both the bottom. The filter was in fact a
fine mesh and the water was filtered through it.
Three gallons we would put in a can in which, ac-
cording to the customary method in that locality, a cloth
was put over the can and the water was poured through it.
The water would be put in contact with the oysters. These
would constitute samples A and B. Samples C and D we
would have in a similar manner except that we would
have a preliminary washing of, say, thirty minutes. This
washing they claimed was necessary to remove film, bits
of shell, sand or debris, etc. We would then treat
them as usual, washing the oysters in the
washing according to local custom. I might say it was
customary in certain localities to soak their oysters in
fresh water after they have been washed. In some in-
stances, this water is running water. This washing pro-
cess enabled the oyster, by a process of osmosis, to in-
crease in bulk exposure from ten to twenty-five per cent
in weight. In fact, the oysters will float in
this very salt water. As far as the points of shipment
we took six gallons of oysters one evening that had not
been treated in any manner, that is, right off the boat
from water of reasonable salinity. We drained the excess
off of them and they were placed in a receptacle
for shipment. The next day, the oysters were again
sampled. We measured the oysters accurately,
placed them in the box, and filled the box with water.

quarter full of ordinary water and put in a chunk of ice. The next day we measured those oysters after shaking them up and draining them, and found that that particular test gave an increase of something like a gallon and a pint; at any rate, it was a considerable increase. When I went to pay for them, the man, knowing, of course, that we were Government people, wanted to charge us for the seven and a fraction gallons. He quoted at first an excessive price for the oysters. I objected to the price as I had found out that I could get the oysters cheaper at other places in the immediate neighborhood. Then he wanted to charge me for seven and a fraction gallons. I said, if I had paid for them the evening before, it would have been necessary to pay for only six gallons. Finally he came down to the exact price which I had agreed to pay. Those oysters did not take up anything like the amount of water they would have if they had had a chance. It depends upon the salinity of the oysters. If they had been put in running fresh water they would have increased possibly a gallon and a half -- nearly two gallons. It depends upon the salinity of the oysters, the temperature, and the previous freedom of contact with fresh water to reach the maximum amount of increase in volume by soaking. That illustrates to a nicety how the public is being deceived by that practice. Our methods of making shipments and the previous treating of the oysters varied somewhat ac-

...full of ordinary water and put in a glass of ...
...and found that that particular ...
...was an increase of something like a gallon and a half;
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...wanted people, wanted to charge us for the water and
...a gallon gallon. He quoted at first an excessive price
...the price. I refused to pay more than I had paid
...in the immediate neighborhood. Then he wanted to charge
...a gallon and a half gallon. I said, all I had
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...necessary to pay for only six gallons. Finally he came down
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...a gallon and a half -- nearly two gallons. I depend upon
...the salinity of the water, the temperature, and the pres-
...sure freedom of contact with fresh water to reach the
...and an amount of increase in volume by evaporation. These
...illustrate as a matter of fact the fact that it being decided
...that question. Our methods of making measurements and
...the various freezing of the system varied somewhat as

according to the location of the oysters. The kegs and barrel which we had prepared were shipped in duplicate. A set of samples, for instance, from Norfolk were sent to Chicago, with instructions not to ice during transit. This was during winter, and we attempted to put enough ice in or around the package to carry it to Chicago. Then our men at Chicago received the shipments and inspected them and re-iced them -- whether it was ice around the can or in contact with the oyster. Then they would be shipped back to Washington. Meanwhile we notified a committee of practical oystermen to meet in our laboratories and inspect these oysters when they arrived in Washington. I should have said that the other portion of the duplicate set of samples was sent directly to Washington and kept under good conditions. Then we had fresh oysters sent to Washington that were only a day or two old, in order to have them serve as standards for comparison. The practical oystermen came and saw the samples taken from the tubs or containers. They were then placed on platters around a table, each sample being numbered. Each oysterman examined the various samples, beginning with No. 1, going around the table -- by inspection, tasting, or in any other way they desired. They were permitted to make notes, not knowing the previous treatment that the oysters had received. Then, after they had taken full data and had agreed among themselves that such and such oysters had

...the ...
...we had prepared were shipped in duplicate.
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...when instructions had to be ...
...
...to ... the packages to ... it to Chicago. Then
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... in contact with the water. Then they would be
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... have them serve as standards for comparison. The practi-
... and operators came and saw the samples taken from the tube
... in ...
... table, each sample being numbered. Each operator ex-
...
... among the tube -- by inspection, ... on in any
... other way they desired. They were permitted to make notes,
... and knowing the previous statement that the operators had
... desired. Then, after they had taken full data and had
... among themselves that each and each operator had

certain characteristics, they submitted their report. Each man expressed his opinion on each set of samples. After they had told us all this we told them what treatment the oysters had received. By that demonstration we showed the oystermen themselves just what had been done, and it drove home to them very forcibly what we had been contending could be done. It was very interesting to see how much surprised those men were, after telling them what treatment the oysters had received, to think that such a thing could be done. They practically all agreed that the oysters that either had not been washed at all or had been slightly washed were invariably the best--that is, so far as taste, appearance and other keeping qualities, consistency, and so on, were concerned. In our regulations we are permitting a slight washing of oysters. In many instances after they are shucked and handled by persons with filthy hands, the shells being dirty, etc., we recognize the necessity of slight washing, but not soaking as they do in many instances. There is one phase of the previous treatment of oysters that is being engaged in today, which is one of the most dangerous practices that we have to contend with in regard to public health standards, and that is the "floating" of oysters. This floating of oysters is distinguished from soaking. The soaking or washing of oysters is done after the oyster is shucked, while the floating or drinking

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...The soaking. The soaking or washing of oysters is done
after the oyster is shucked, while the floating or dunking

is done while the oyster is in the shell prior to shucking. The floating is done for practically the same purpose as the soaking, viz., to increase their bulk, and it is a question of financial gain. That is about what it amounts to. They put up various excuses to try to explain the practice. The method may be carried on in two ways. One is by the use of artificially constructed rafts or floats anywhere from 20 to 40 feet long, with porous bottoms. The oysters in the shell are placed in this float and allowed to remain there from one to three changes of tide. They claim that at the beginning of the flood tide the oyster will drink, as they call it; in other words, the oyster takes up water, which they call the fattening process. It is a pseudo fattening process and is nothing more than is the similar process of pouring so much buttermilk down a calf's throat; it simply bloats the oyster up. By the process of osmosis their bulk is increased, this depending upon the salinity of the water.

MR. TAYLOR: Is this floating done in fresh water?

DR. STILES: Not in entirely fresh water but what we call brackish water. These floats are generally placed for convenience and not for public safety. For instance, in certain cities right down back of their oyster house, right over the bank where the water would be known to be polluted from the sewers, they would have their oyster float.

is more while the object is in the self before the lightning.
The lightning is down from the clouds, the same process as
the lightning, viz., the lightning is a ball, and it is a
ball of electrical gas. It is about 100 ft. in diameter
and it is put up with the lightning to try to explain the
process. The method was to connect it in two ways. One
is by the use of artificial, constructed wires or floats
suspended from 20 to 40 feet long, with various devices. The
floats in the shell are placed in this way and allowed
to remain there from one to three days of time. They
claim that at the beginning of the flood tide the water
will drain, as they call it; in other words, the water
comes up water, which they call the falling process.
It is a pseudo floating process and is nothing more than
the rising process of pouring no more water into the
water's throat; it simply floats the water up. The
process of raising the water is increased, and the depend-
ence upon the activity of the water.

MR. TAYLOR: Is this floating done in fresh water?
MR. TAYLOR: Not in ordinary fresh water but in sea
water. The floats are suspended in places
of convenience and are for public safety. The floats
are certain of the right down from of which they come,
and it is the fact that the water will be raised to be
raised from the bottom, they would have been out.

MR. TAYLOR: They don't float them at the beds?

DR. STILES: No, not where the oysters are grown.

It is done at the mouth of a river where the water is brackish. They dump them on the sand under the water where the water is considerably fresher, and such water is more apt to be polluted than water in the sea or some distance from the land. That is where the danger is and what we have to look out for in the regulation of the oyster industry. That practice has been discontinued in many sections, but it is still carried on in some places. We find on the bill of fare in hotels and cafes the famous blue point oysters that may have come from the true blue point region, but nowadays the oystermen will advertise most any small oyster as blue points regardless of the section from which it comes. That practice, I believe, has much more significance than merely to the oyster trade—that is, the matter of naming goods from the place in which they are grown. In the case of some of these truly famous blue point oysters, coming from the Blue Point region (which is the south side of Long Island, along a certain prescribed territory), even there today they are practicing floating and in very questionable places too. I have seen those oysters floated within 15 or 20 feet of privy vaults where human excrement was undoubtedly going into the water and contaminating it. No person would think of going down there and drinking that water, yet ladies and gentlemen

will sit down and eat oysters on the half shell which may have been taken from water badly polluted. The liquor of the oyster will represent in a measure the character of the waters in which they were grown. But the treatment which I have been mentioning -- the floating, soaking, kind of container, sanitary condition of the oyster house, method of handling, salinity of the water in which the oysters are grown -- are all factors which tend to influence the shipping or keeping quality of the oyster. It is not an uncommon thing, the oystermen tell us, for them to keep oysters in the shell in the winter time anywhere from one to three months. Oysters may be kept in the holds of houseboats for long periods. Just what changes take place during this period of storage we have not sufficient data to draw conclusions. It is one of the problems that incidentally we are trying to get information about as much as we can. In the matter of keeping oysters, so far as we are informed at the present time, oysters in cool weather do not require icing. As a matter of fact, they will keep better (at least oystermen claim that, and so far as we have been able to find out ourselves it is true) in moderately cool temperature than when surrounded by ice. They seem to perish more quickly, as most cold storage products will do, after they have been subjected to a cold temperature and then are brought out into warmer conditions.

Our work today is largely a matter of police duty under the Pure Food Act, although we have gained a great deal of valuable information while carrying on such work. If I were going to go over the same ground again -- in fact, I have recommended to one or two State Boards of Health where they have wanted to undertake similar investigations for themselves -- I would recommend securing, with any possible financial aid obtainable, a house-boat or a suitable boat provided with the necessary equipment, not necessarily elaborate, for bacteriological and, if necessary, chemical work, but more particularly bacteriological work. I would recommend that such equipment be installed in such a boat, with living quarters for such a crew as necessary, and would go right out over the beds along the Atlantic coast. The beds are very extensive all along the Atlantic coast. The coast of Maine is famous for the clam industry -- soft-shell clams -- and down around Cape Cod in Massachusetts we have the hard-shell clams, while oysters begin along the coast of Massachusetts and from there on southward, extending around to the Gulf of Mexico. The beds in the South are quite extensive and at the present time oyster beds are being cultivated quite extensively on the Pacific coast from California up to Washington. The Pacific coast oysters are mostly replanted from eastern waters. The seed for

the Pacific coast oysterx beds are furnished from Connecticut waters and shipped by rail across the country and replanted. The industry is rapidly growing. Within two or three years the oysters are taken up and utilized for food purposes. In some sections of the country they depend largely on the natural growth of the oysters and they are not practicing the art of agriculture as we do on the land and as they should do and as they recognize they ought to be doing. The beds in many localities, therefore, are becoming depleted, while in other localities they claim they have an abundant supply, but there are great opportunities for benefiting this, one of our greatest of industries. The results of such investigations as we have been making in regard to methods of shipping are revolutionizing the industry, so far as the shipping is concerned, and oysters are being shipped into the remoter sections of the country where they never used to think they could get such a product as fresh oysters, and it will not be long before the industry will be placed on a much more satisfactory basis. The decision of the Pure Food Board will work a hardship to some in having to furnish new containers. I might say that after the first of May or thereabouts no oyster will be allowed to be shipped in contact with ice. They will all have to be placed in containers that have been sterilized or new cans surrounded with ice in outside containers sufficiently large to hold

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enough ice to carry them to destination, and the floating and soaking of oysters will be a thing of the past, so far as the legal end of it is concerned, but regulations are now in force regarding the sanitary end of the oyster beds, handling, and so on, with the exception of the matter of soaking. As a whole, there is a great amount of work yet that should be done. As a matter of fact, it occurs to me that it is just the beginning of the work. From the oyster growers and dealers' standpoint it has just begun. They ought to take hold and, with the proper cooperation and assistance to guide them as to what could be done, the industry could be gradually revolutionized and benefited by careful investigations, and many many people could be provided with a fine article of food that they are being deprived of today.

MR. POWELL: This has been a very interesting discussion. I was interested in hearing how the police side was developed. I suppose there are great opportunities for constructional work entirely outside of the police function of the Department -- that is, investigations of methods which lead to a better oyster industry. Do you think it possible to combine the two successfully in making an investigation or are you likely to incur antagonism where you are working from the police standpoint that interferes with the investigational and educational work that you need to put into operation?

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DR. STILES: You see in the beginning our work was more of a cooperative nature, although the men were very much afraid, as was said this morning, that we would interfere with the business.

MR. POWELL: They are not entirely like the orange men.

DR. STILES: You read about men being kidnapped and kept out on the oyster boats. The men stay out for days and weeks with a scant variety of a food supply, with bad conditions to work with, and their whole idea is to get a few dollars out of the business. It is a hard job. Of course, the growers, the men who live on land and who handle the goods are another class and we get along very well with them.

MR. POWELL: In an industry like that very often the abuses will only be corrected by the law. The people are not susceptible to the kind of education that might be applied to a different class of people.

DR. STILES: One man told me just recently that he was going to continue soaking his oysters until they compelled him to stop.

MR. POWELL: The same condition exists with regard to citrus fruits in sections where they have a hard frost. A great deal of fruit is frozen and the growers start gangs to pick the frozen fruit and then ship it to market. The people doing this will say "Why should I stop selling

DR. WILSON: The way in which the people are...
...the way in which the people are...
...the way in which the people are...

DR. WILSON: They are not entirely like the...

DR. WILSON: You have about men being...
...on the other hand. The way they are...
...with a heavy variety of a food supply...
...to work with, and the whole idea is to...
...out of the business. It is a hard job...
...the business, the way they live on land and...
...the business and the way they live on land and...

DR. WILSON: In an industry like that very often...
...the business will only be connected by the fact...
...the business will only be connected by the fact...
...the business will only be connected by the fact...

DR. WILSON: One man told me just recently that he...
...the business will only be connected by the fact...
...the business will only be connected by the fact...

DR. WILSON: The same condition exists with regard...
...the business will only be connected by the fact...
...the business will only be connected by the fact...
...the business will only be connected by the fact...

frozen fruit when everybody else sells it." If there are no more phases that Dr. Stiles would like to bring up, I will call on Mr. Gore. Mr. Gore has been doing a lot of work on the chemical changes that take place in fruits and in some of the fruit products in cold temperatures. He has been closely associated with the work in Plant Industry for several years. We will be glad to have Mr. Gore give a general outline of what he is doing.

MR. GORE: My line of work is so small that it is almost insignificant in comparison with these researches with articles of great commercial importance. Cider occupies rather a small place in commerce at the present time -- much smaller than it should, largely on account of the exploitation of the manufacture of beer. Benzoate of soda is generally used in this country as a preservative of cider. For several years I have been trying to master the subject of handling cider commercially without using a preservative. The first experiments were in the use of heat. This has several disadvantages. There is a distinct change in flavor, and when a large sized package of sterilized cider is opened the juice is apt to become moldy before it is used. Last year experiments were made on the cold storage of cider. The cider was prepared in the laboratory, chilled, and kept at the cold storage warehouse at Center Market at 32° F. These ciders kept fifty days on the average without showing any fermentation

whatever. The experiment was repeated this year in co-operation with Dr. Stiles on the bacteriological side. The method of cooling after pressing, used this year, followed standard dairy practice. Mr. Rogers cooperated in suggesting the forms of apparatus most suitable for this purpose. The sample on the table is Winesap made on the 30th of November. It shows no signs of fermentation. The flavor has kept very well, as I think you will agree if any of you care to sample the cider after the close of the meeting. We have carried on a number of experiments with the cider, having handled in all nine different varieties of cider. The process consisted simply in cooling the freshly expressed juice sharply to the freezing point and holding it there. One of the lines of work in connection with cider has been in the use of a milk separator in removing organisms mechanically. Dr. Stiles has made counts on this cider passing through the separator and you can see the results rather graphically from these photographs of poured plates, showing the relative number of molds before and after going through the separator. The flavor of cider holds up remarkably, and, when we come to the finer varieties of apples, we are going to get a magnificent cider that ought to find a ready sale. The work is still in its experimental stage and its commercial exploitation is still in the future.

MR. POWELL: Mr. Gore has also supplemented the fruit storage work in a very helpful way by making a study of the chemical changes that take place during the growth of various fruits, and also the chemical changes that take place in fruits in cold storage in comparison with those in common storage. He did not speak of that, but there are many applications of that work that we have been able to take back into the field. The fact is brought out, too, that field work can not be separated from the most serious kind of laboratory research. Without being supplemented by the other, neither can go very far. It has been a very effective ~~piece~~ and helpful piece of cooperation for both Bureaus.

MR. GORE: I have an instrument here that I want to show, the Zeiss Immersion Refractometer, because I believe that it will be useful to some of the research workers in cold storage. It has been on the market about five years. It is very useful in determining slight changes in density of liquids and has been very useful in the work on cider in determining the relative rate of fermentation. I am sure the instrument ought to find a wide application in cold storage work where we have to detect very slight changes.

MR. TAYLOR: Is it useful for determining water in alcohol?

MR. GORE: Yes, you can use it for that.

MR. RAWL: What do you call that instrument?

MR. GORE: An immersion refractometer.

MR. RAWL: Can you use it for determining acetic acid?

MR. GORE: It is rather limited in its scope. You can not use it on fats. I do not know about acetic acid. Undoubtedly you can determine it through a certain range with this instrument.

MR. POWELL: One of the difficulties we found in the fruit transportation work was lack of cold storage facilities in parts of the country where we had to carry on investigations. To overcome this and in building up a staff around the fruit storage and transportation problems, it was necessary to bring in someone who was familiar with the engineering principles of refrigeration. Mr. Dennis came to the Bureau of Plant Industry as a mechanical refrigeration engineer two or three years ago and has had charge of some of the engineering features of the transportation and storage work. He has planned and built a very unique and useful piece of apparatus in the form of a portable refrigerating plant which can be used in the experimental work in any part of the United States. I think we would all be interested in hearing how that can be made useful in extending the Department's work into sections where they have no facilities of that type.

Q. Now, what is the first thing you did?
A. I went to the laboratory.
Q. Can you use it for determining results?

Q. Now, it is rather limited in its scope, you
can use it on tape. I do not know about results.
Q. Now, it is a laboratory.

Q. Now, one of the difficulties we found in the
first transportation work was lack of cold storage facilities.
Q. In parts of the country where we had to carry on
transportation. To overcome this and in building up a
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it was necessary to bring in someone who was familiar with
the existing facilities of transportation. We found
one in the Bureau of Plant Industry as a mechanical re-
frigeration and heat two or three years ago and has had
knowledge of some of the mechanical features of the plant
refrigeration and storage work. He has planned and built a
very unique and useful piece of apparatus in the form of
a portable refrigeration plant which can be used in the
experimental work in any part of the United States. I
think we could all be interested in having one and we
are also useful in extending the Department's work into
regions where they have no facilities of that type.

MR. DENNIS: I think perhaps I can make my description a little bit briefer by showing you one or two photographs. In order to provide refrigeration facilities of sufficient size to accomplish what seemed to be desirable within the space that seemed to be possible, it was necessary to arrange a very compact piece of apparatus. A small ammonia-compression refrigerating plant was mounted in a railway box car especially built for the purpose, as shown in the photograph which I will pass around. It does not differ materially in appearance from an ordinary box car but the machinery is very compactly placed inside. The refrigerating capacity of this plant is equal to that furnished by 12 tons of ice daily. It is what is known as a 12-ton refrigerating plant. One half of the car is very heavily insulated and carries about a mile of expansion coils. The other half of the car contains the machinery, packed in just as closely as it is possible to pack it, leaving, as a matter of fact, very little space for operating and handling, adjusting and repairing the machinery. We have had the plant in operation during the past year in California with entirely successful results. It is arranged for precooling work, that is, for delivering a blast of cold air, which can be directed wherever desired. We have been using it as a precooling plant for cooling fruits (oranges and table grapes) after loading

MR. MILLER: I think perhaps I can make my descrip-
tion a little bit better by showing you one or two photo-
graphs. In order to provide information facilities of
the plant mine to some extent about some of the details
of the space that is used as the possible, it was neces-
sary to arrange a very compact piece of apparatus. A
small ammonia-compressor with a reversing plant was mounted
in a railway box car especially built for the purpose, as
shown in the photograph which I will now present. It does
not differ materially in appearance from an ordinary box
car but the machinery is very compactly placed inside.
The refrigerating capacity of this plant is equal to that
contained by 12 tons of ice daily. It is what is known
as a 12-ton refrigerating plant. One half of the car is
very heavily insulated and carries about a mile of pipe-
line coils. The other half of the car contains the ma-
chinery, packed in just as closely as it is possible to
pack it, leaving, as a matter of fact, very little space
for the machinery and piping, situated as it is in
the center. We have had the plant in operation during the
past year in California with entirely successful results.
It is arranged for producing water, but is, for delivery
of a plant of cold air, which can be directed wherever
desired. We have been using it as a producing plant for
selling fruits (oranges and lemons grapes) after leaving

in refrigerator cars, by forcing a cold blast into one end of the car and returning it from the other end back to the refrigerating car to be again cooled and recirculated. While the plant is arranged particularly for this work, by a very simple modification it can be used to distribute refrigeration, either by cold brine or by direct expansion of the ammonia in coils located wherever it is desired to produce refrigeration. One of the problems that seems to be in sight is to provide opportunities for the study of the effect of different temperatures and humidities on the storage of various products under very exact laboratory conditions and, if necessary, we might use this plant in this way. We have the refrigeration facilities, and it is merely a matter of providing suitable insulated chambers of such size as may seem to be most feasible and under very exact automatic control, under some such system as is already in use in the new building of the Bureau of Chemistry, which some of the people over there, I presume, can tell us more about than I can. With a plant of this character and with small compartments which can be provided in portable form, if necessary, a more or less complete laboratory equipment for the study of the effect of different temperatures on storage products on a laboratory scale can be provided, without very much difficulty and without very great expenditure, at the place of production wherever the railroad tracks are available.

to carry out work, by forcing a cold blast into one
end of the can and retaining it from the other end back
in the container can be again cooled and re-used.
While the glass is removed particularly for
this work, by a very simple modification it can be used
as a device for studying the effect of different temperatures
on the expansion of the gas in a closed container.
It is desired to make a modification. One of the prob-
lems that seems to be in sight is to provide opportunities
for the study of the effect of different temperatures and
conditions on the change of volume of gases under very
exact laboratory conditions and, if necessary, we shall
use this glass in that way. To have the container in
position, and it is merely a matter of providing suit-
able insulated chambers of such size as may seem to be
suitable and under very exact automatic control, under
such a system as is already in use in the new building
at the Bureau of Standards, which was built by the
Bureau, I presume, can tell me more about than I can. With
a plant of this character and with small components
which can be provided in portable form, if necessary, a
very simple and efficient laboratory instrument for the study
of the effect of different temperatures on volume pro-
cesses on a laboratory scale can be provided, without very
great difficulty and without very great expense, at the
Bureau of Production wherever the required tools and equip-

MR. POWELL: That is absolutely essential for certain phases of the fruit work.

MR. DENIS: In the precooling work where prompt cooling is a factor in the case (and "precooling" simply means prompt cooling), it was essential that the refrigeration plant should be brought as near as possible to the point of production. The refrigerating plants which were available were always located some distance from the packing house or orchard and it was not possible to effectually precool very much of the fruit, at least except in very few cases, without considerable delay between the time of picking and the time of cooling, but this plant can be located wherever it seems most desirable and the cooling accomplished quite promptly.

I think that covers the principal features. I do not think it is necessary to go into the details of the construction of the plant unless some one is interested in that phase of it.

MR. POWELL: This brings out again the necessity, if we are following any particular investigation, of following it in any direction it leads, if it is to result in the best good to the industry. We might have carried on a lot of laboratory work and got some very good facts and principles, but nothing like what has been accomplished through Mr. Dennis' extensive field work. There is probably now something over a million or a million and a half dollars being expended on large precooling plants in

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MR. BOWEN: This brings out again the necessity, if
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... Mr. Darnall, extensive field work. There is
... now something over a million or a million and a
... being expended on large precooling plants in

several places in the West as a result of the facts and principles derived from this work.

MR. DENNIS: I may say in connection with this that the capacity of this plant was chosen as being the smallest that it seemed to be desirable to employ in the cooling of carload lots of perishable products. Of course, the larger the plant the more rapidly the cooling can be accomplished. In our case it was a matter of limitation to the size of an ordinary box car, which limited the size of machinery that could be employed, and it was necessary even at that to crowd the machinery to the utmost possible limit, and that that was done I think you can gather from an examination of the drawing of the machinery of the plant.

MR. POWELL: The transcontinental railroads are now erecting very large commercial plants to be used in the cooling of fruits after loading and before sending them East. They have assembling points, not at stations but at points where a large proportion of the cars of a section must pass in going East and which can be reached relatively quickly after the fruit is picked. For instance, in southern California everything that goes out has to go through Colton or San Bernardino. They run the cars alongside the plant and blow large volumes of cold air through each car, returning the air to the plant to be recirculated.

placed there in the field as a result of the tests and
trials derived from this work.

MR. POWELL: I may say in connection with this that

the majority of this plant was chosen as being the small-
est and it seemed to be best able to employ in the cool-
ing of certain lots of perishable products. Of course,

the larger the plant the more cooling it would have and the
management. It was used in the winter in California

at the site of an ordinary box car, which limited the
size of machinery that could be employed, and it was not
even at that to crowd the machinery to the narrow

possible limit, and that that was done I think you can
see from an examination of the drawing of the machinery
at the plant.

MR. POWELL: The transcontinental railroads are now
erecting very large commercial plants to be used in the
handling of fruit after loading and before reaching the
market. They have assembling points, not at stations but
at points where a large proportion of the cars of a sec-
tion must pass in going West and which can be worked re-
latively quickly after the fruit is picked. For instance,
in California everything that goes out has to go
through Colton or San Bernardino. They run the cars along
the coast and the fruit is taken off at the various
points, returning the cars to the plant to be reloaded.

MR. RAWL: Is ice satisfactory in precooling?

MR. POWELL: It is not rapid enough.

MR. RAWL: How about ice and salt?

MR. POWELL: That helps but is still not fast enough.

MR. RAWL: Could you arrange a small house or storage room where you could precool a carload at a time with ice and salt?

MR. POWELL: Mr. Dennis is going to get out a publication in the near future on small plants adapted to farm use. Are there any more questions along this line?

MR. ANDREWS: I don't know whether I understand the purpose of this car. Is it to furnish cold air to other cars?

MR. POWELL: It has no commercial application. It is a twelve-ton plant that furnishes refrigeration to be used in our experimental work.

MR. TAYLOR: It can be connected up with any structure or any container alongside of which you can place a car. It is merely a piece of apparatus to be taken from place to place by attaching it to a train.

MR. POWELL: The railroads have given their heartiest cooperation in this type of work. We could not do anything without their cooperation. Usually the plan is to have a track built alongside of the regular railroad track, set the plant up and leave it there for the season and

MR. BROWN: It is not necessary to have it.

MR. BROWN: It is not really enough.

MR. BROWN: How about the end of it?

MR. BROWN: That helps but it still has to be done.

MR. BROWN: Could you arrange a small house or other-

and then if you could proceed a certain at a time with

the same way?

MR. BROWN: It would be better to have a small-

house in the rear of the main house and to have it

and then any more questions along this line?

MR. BROWN: I don't know whether I understand the

purpose of this car. Is it to furnish cold air to clear

the

MR. BROWN: It has no commercial application. It

is a twelve-ton plant that furnishes refrigeration to be

used in our experimental work.

MR. BROWN: It can be connected up with any other

type of any container elements of which you can place a

car. It is merely a bit of apparatus to be taken from

place to place by attaching it to a train.

MR. BROWN: The following is a list of the

apparatus in this line of work. We could not do any

more without their cooperation. Usually the plan is to

have a truck with a number of the various kinds of trucks

and the plant up and have it there for the summer and

then, as carloads of produce are to be cooled, they are run alongside of this refrigerator car, cooled as long as necessary and then started East, and the inspectors of the Bureau, when the car reaches New York, inspect the fruit that has been handled in different ways before being put into the car. Mr. Dennis gets the engineering data that is secured from the cooling processes.

MR. DENNIS: As an example of the way in which we are able to utilize this plant, I may say that this has been operated in Lodi, California, and in connection with other experimental shipments, of table grapes, at the same place. This plant made it possible to make shipments after precooling and regular icing as part of one large general experiment, engineering data being obtained on the cooling of the fruit and on the refrigeration supplied at the same time the shipping experiments were being carried on in connection with that part of the work. We could not have obtained that sort of data in any other way because there was no cold-storage plant available at that point at which cooling could have been done.

MR. POWELL: Are there any more questions along this line? We have one more branch in the Bureau of Plant Industry that has to do with investigations of the factors that enter into the question of grades of grain. Mr. Shanahan has the grain work in charge and will give an outline of the general problems and the methods of handling

the grain work. This grain work, I will say, is a subject that the Interstate Commerce Commission asked the Department to investigate with a view to determining the factors that underlie losses in grain in transit.

MR. SHANAHAN: This transportation problem, so far as grain is concerned, is only incidental to a great group of problems that affect the values of grain, and I take it the same is true of most of the industries that have been spoken of here today. The investigations styled Grain Standardization were begun primarily in order to find out what factors of quality and condition were considered in fixing the market values of grain by grades, to ascertain the proper weight to be given each factor, and to correlate those factors with the commercial grades that represented the market values of grain. That leads into a large field which presents many problems. I do not believe I could attempt to go into all of them, but we are trying to ascertain what the commercial grades amount to, if they can be fixed on a reasonably sound basis, and in doing so we are obliged to find out the causes of deterioration that takes place in the transportation and storage of grain. There are a great many questions involved and I take it that what you want especially is an outline of the transportation problems that we are studying.

MR. POWELL: Just the high lights.

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... of grain by grade,
... to be given each factor,
... the economic grades
... of grain. That factor
... many problems. I do
... to go into all of them, but
... to, it they can be fitted on a reasonably sound
... and in doing so we are obliged to find out the
... of distribution that takes place in the transpor-
... . There are a great many
... involved and I take it that what you want expec-
... is an outline of the transportation problem and that
...
... that the ...

MR. SHANAHAN: Dr. Duvel has that work in charge and perhaps we had better have him tell you what he is doing. I may say that the further we get into the problem as a whole the more we find that sub-problems lead right back to the farm -- back to where the grain is grown; to the questions of how it is grown, and especially how it is handled, how it is harvested and how it is handled in storage and in transportation. That is not only true of corn, but it is so of all grain. The problem of deterioration in storage and in transit seems to simmer down to a question of how much moisture is in the grain when it leaves the farm. If the grain is sufficiently dry when it is put in storage or in cars for transportation, it will carry almost indefinitely without any deterioration, but, if it contains an excessive amount of moisture, it leads to complications and trouble which you probably all understand, and I take it that the same is true of almost all commodities that are affected by high moisture contents and high temperatures. It is not only true of grains, but it is true of fruits, although, of course, you can not get rid of the moisture in fruit.

MR. POWELL: Are you planning to go back into the field and determine by experimental work the factors that influence the moisture content?

MR. SHANAHAN: Yes, that and other things. There are two considerations that especially enter into the market

value of grain, namely, quality and condition. With special reference to corn, condition is an important factor; the quality is influenced more or less by soil and climatic conditions during production and to some extent, more especially in some sections, by the method of harvesting and taking care of it after harvest. I have in mind one special preliminary experiment that was carried on in North Dakota not long ago in studying the effect of what is known as sweating in wheat after harvesting and before it is ready to mill. Many of the millers seem to think that this sweating is a natural process whereby wheat gets rid of some noxious characteristics and that flour made of wheat before it goes through the sweating process will not keep and is not good flour. I instructed our men to investigate that question and find out, if possible, what the facts in the case were. One of our men went into a field of wheat in North Dakota when it was being harvested and secured a sample of the wheat as it was being threshed from the shock. That wheat was put in a little storage bin at the experimental mill of the North Dakota Experiment Station and kept there, I understand, about six weeks before being ground. A sample of this wheat and a sample of wheat out of the same field that has been stacked for six weeks before threshing were sent to the Minneapolis market to be graded. The sample threshed from the stack graded No. 1 and the other graded

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No. 2. The owner of the wheat made a statement, which I believe was true, namely, that, if the wheat that had been threshed out of the shock had been marketed at the time it was threshed, it would not have graded better than No. 3 or No. 4. That shows to me the possibility for a line of constructive work with wheat. The actual difference in value between the wheat that was threshed from the shock and the wheat that was threshed from the stack must have been at least between five and six cents per bushel.

It seems to me that we have got to demonstrate, before we can get the farmer to take the extra precaution of stacking his wheat or to put additional money into the handling, that he can get it back when he sells his grain. That leads to another thought. The commercial methods and practices in marketing grain are today almost entirely against the man who will put that extra money into the growing or harvesting of his grain. At almost every country railroad station in the grain growing sections are little country elevators. The farmers around bring in their grain to these elevators where it is bought practically as one grade. It is bought as one grade for several reasons, one of the main reasons being that there is usually competition and, in order to keep the good will of the farmers, the farmer who has poor grain is paid the same price for his grain as is paid the farmer who has

good grain. Not only that, but when the grain reaches the larger markets it is graded there and the country shipper who buys it from the farmer is settled with on the basis of the inspection certificates, at a uniform price for the day. The range in the intrinsic worth within the individual grades of the market is sometimes several cents per bushel and this range is not constant. It is therefore necessary that the buyer at the country station protect himself by sufficient latitude in buying. Usually the grades are much more rigid when the grain arrives in the market than when it is shipped out. On entering the markets the grain is graded mostly 1, 2, and 3 and 4, and usually go out of the markets as higher grades. If the grain is destined for European points, the mixing does not stop at the primary market but the grain is brought to the seaboard and again mixed. So that the whole process and method of handling commercial grain is one that tends to bring the prices of the different kinds of grain to a common level. If I correctly interpreted some of the talks here today, I think that is true of other commodities as well; that is, the methods of handling those commodities gives little chance for discrimination or selection by the consumer, especially in an industry where the commodity is sold so largely on certificates of inspection instead of by sample, as is the case in the grain business. So you see we have quite a problem and a wide

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field in which there appears to be great possibilities.

With regard to our transportation work, Dr. Duvel has had charge of that, has largely worked out the details, and can give you an outline of what he is doing, what he expects to do, and some of the results that have been obtained thus far.

DR. DUVEL: In our grain transportation work we have dealt primarily with corn, looking into the other grains only incidentally as they come up in connection with the work. We have examined corn at point of shipment and at destination and in a number of cases while in transit. The work has been done primarily in cooperation with the Illinois Central Railroad from the central part of the State of Illinois to New Orleans. Where cars of corn were examined only at point of shipment and at destination, the examinations were as a rule made by different men; but when one of the men accompanied the shipments, he also superintended the loading, examined the corn in transit, took records of temperature and humidity of the air and made a careful study of the condition of the corn at the time of unloading, just as has been done in the fruit work. Shipments have also been made East to Baltimore. In Baltimore, however, most of the work has been with corn in storage to determine the deterioration of the corn in storage and also the shrinkage, in which questions the transportation companies and at the present time the

Interstate Commerce Commission are very much interested. Part of these results were given last year, where a certain amount of grain was put into the bin and held there for some considerable time, making studies and observations from time to time while this investigation was in progress. The corn was kept there until it began to get out of condition and until fermentation set in and the temperature had increased to about 130 or 140 degrees F. The same thing was true with storage experiments at New Orleans. In corn most of the difficulty seems to be in the excessive amount of moisture. We have taken some of this damaged corn and afterwards dried it down to a certain percentage of moisture and then stored it, and in that condition it seems to hold up very well. In New Orleans we dried a good quality of corn immediately on receipt at that market and checked it with corn that was not dried but was shipped from the same country elevator at the same time. The corn that was dried we were able to keep until along into June without any appreciable deterioration, while the other corn reached a temperature of 143 degrees F. in two or three weeks. But as Mr. Shanahan brought out in his remarks, in the main, the difference in price between the dried and the undried corn is not sufficient to make up for the cost of drying and the shrinkage. Under commercial conditions the only corn that they dry is corn that is out of condition, in order to put it back into condition.

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... into condition.

MR. TAYLOR: To what is the excessive moisture due?

DR. DUVEL: The excessive moisture, I contend, is largely due to two causes--the demand for new corn as it comes in and the high prices obtained for it, which makes the farmers anxious to get that corn on the market, and in a number of cases they are compelled to get it on the market as soon as possible, especially from rented farms, because they need money. In a number of cases also where they market their surplus they do not have storage capacity to take care of it and they fill up their cribs and throw the balance on the market.

MR. TAYLOR: It is a question of unseasoned corn?

DR. DUVEL: It is unseasoned corn, and in this connection I wish to say, as we have agitated for some time, there must be a change of attitude in the question of corn breeding. There has been a tendency lately to breed corn for yield and yield only, and it is a principle that is entirely wrong from the commercial point of view, because corn does not go into the market in proper condition.

MR. TAYLOR: The breeders are breeding for weight?

DR. DUVEL: Yes. The farmers are taking advantage of that and are marketing corn with just as much water in it as they can get the elevator to accept. They will continue to do so until the grain people buy according to moisture content or, to be more exact, until the dealers buy on the basis of the dry matter. That time is coming

and coming quickly.

We have been carrying on experiments in Illinois in a number of places, taking samples twice a month from the cribs as they are being filled direct from the fields. This work will be continued throughout the winter. These samples are taken from cribs which we have assurance will stand until late next summer, and at one place we have a crib that still contains 1908 corn. Following are some of the results of moisture tests of samples taken early in January: Sibley, 20.1; Blue Mound, 18.6; Osbernville, 17.5; Garnea, 19.1; Argenta, 20.1. Samples submitted by grain merchants averaged 19.2 per cent, which is about the average moisture content of all corn through Illinois at this time. We are making these studies to see how fast that corn dries out and in that connection see whether the farmer can afford to put up good cribs to protect his corn, and along with that studying the condition of corn in poorly constructed cribs, open cribs with a few boards thrown over the top for a cover or slatted cribs that let in lots of snow and get wet over the top and down the sides. A great deal of the corn coming into market at the present time is all mixed with snow and ice. It is not uncommon to find in a number of places corn with from 25 to 30 per cent moisture as it comes from the field, that is, late maturing corn, while other corn is being harvested that will not carry over 15 or 16 per cent, all

and water supply.

It has been carrying on experiments in Illinois in a series of places, taking samples twice a month from the fields as they are being filled direct from the fields. This work will be continued throughout the winter. These samples are taken from corn which we have assurance will stand until late next summer, and at one place we have a yield that will compare favorably with 1908 corn. Following are some of the results of moisture tests of samples taken early in the season: Stiles, 20.1; Mine Point, 18.6; Galesville, 17.5; and 17.1. These are all samples taken from the same corn plants averaged 10.2 per cent, which is about the average moisture content of all corn through Illinois at this time. We are making these studies to see how that that corn does out and in that connection see that the farmer can afford to put up good corn to preserve his seed, and also will be getting the moisture content of the corn at the time it is put up. The results of these studies are as follows: The seeds thrown over the top for a cover or planted under that let in lots of snow and get wet over the top and from the sides. A great deal of the corn coming into market at the present time is all mixed with snow and ice. It is not uncommon to find in a number of places corn with from 10 to 20 per cent moisture as it comes from the fields. This is, of course, not the case with the corn that is harvested and put up for seed.

coming into the same elevator and perhaps off the same farm and all bringing the same price.

MR. DOWNING: Have you any idea how much loss there is through spoilage of corn in the course of a year--in a general way?

DR. DUVEL: In a commercial way?

MR. DOWNING: Yes.

DR. DUVEL: That is a factor that is pretty hard to get at, because it is mixed in and exported and all goes as good corn.

MR. SHANAHAN: It has a tendency to drag down the general price.

DR. DUVEL: It is a question as to how much it pulls down the price--a question you can't determine. We have had this winter at Baltimore some storage work which we have been carrying on in connection with the keeping quality of corn in concrete and in wooden bins. Most of us think that concrete is the ideal thing for a corn bin, but the corn went out of condition three weeks earlier in the concrete bin than in the wooden bin. That was from two carloads of corn shipped on the same day from the same country elevator in Illinois, taken in at the elevator in Baltimore on arrival and thoroughly mixed and half put into one bin and half into the other. These two bins are not in the same elevator, however, but they are of the same size and of about the same capacity.

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MR. POWELL: I don't suppose you have organizations through which you can get large quantities of grain for experimental use just as, for instance, we have in the fruit work?

DR. DUVEL: No organization that we can make use of in that way. That is one difficulty. Another difficulty is the question of handling, as grain is almost universally handled on the carload basis and they will not ship unless we will guarantee them against loss due to deterioration. We have the question up now. We had good support last year from the B. & O. Railroad and the same good cooperation is now effective. At our request they have ordered five cars to be delivered at Decatur, Illinois, for experimental shipments to Baltimore. I am just informed that those cars are in Illinois ready for us to use at any time. At the present time, taking the freight into consideration, corn shipped from central Illinois to Chicago will bring about six cents more per bushel than the same corn delivered in Baltimore. The question in that case is will we want to handle it. It is necessary to do so if we are to continue our experiments. This can be done only by making good the difference in price and, when you are handling four or five thousand bushels, the difference amounts to considerable.

MR. TAYLOR: You have the same question as Mr. Stubenrauch, as to what destination the material is to go

MR. TAYLOR: I don't suppose you have any questions.

Could you get large quantities of grain for

experiment? We just are, for instance, we have in the

field about

MR. TAYLOR: I don't suppose you have any questions.

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it is handled in the same way and they will not

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We have the question up now. We had good

experience with the U. S. Government and the same

operation is now effective. At our request they have

ordered five cars to be delivered at Decatur, Illinois,

for experimental purposes to Baltimore. I am just

worried that these cars are in Illinois ready for us to

get at them. In the future, when we

into consideration, can they be sent from central Illinois to

Illinois will bring about six cents more per bushel than

the same grain delivered in Baltimore. The question is

what can be done to handle it. It is necessary

to be able to handle the grain in the future.

is done only by making good the difference in price and

the cost of handling the grain in the future.

difference amounts to considerable.

MR. TAYLOR: You have the same question as Mr.

Mr. Taylor, as to what destination the material is to be

through to--the question as to whether it should be diverted in accordance with the temptations of the market.

DR. DUVEL: In this case it is either a question of continuing the experiment and paying the freight or allowing the shipment to be diverted.

MR. POWELL: Your grain people are probably not as far along as the fruit people are. In the fruit business we can say, "Here, you must agree to carry out the conditions or we will carry the experiments somewhere else." Probably the grain people have not reached that point.

MR. SHANAHAN: They are not as well organized. Another thing and perhaps the most important: The chances for loss on your fruit proposition are not so great as they are in the grain business.

DR. DUVEL: The fluctuations of the grain market make it uncertain.

MR. SHANAHAN: And the volumes which we have to handle adds to the difficulty. We can not do anything with four or five samples; we have got to take the whole carload in order to get at the actual conditions.

MR. POWELL: Of course, fruit is divided up into packages within a car.

MR. TAYLOR: You have no way of taking a series of samples?

MR. SHANAHAN: We would not have commercial conditions if we did. The value of a carload of corn is worth

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anywhere from \$500 to \$800 and, if we caused a deterioration of from 5 to 10 cents a bushel on that carload of grain, it amounts to something. Just now market conditions have gotten into such shape that the price of corn at Baltimore is only about two cents a bushel lower than it is in Chicago, while the freight from Chicago to Baltimore is about 11 cents.

DR. DUVEL: The rate from Decatur to Chicago is about 6-1/2 cents a hundred and 17-1/2 cents to Baltimore.

MR. SHANAHAN: A difference of about 11 cents. At any rate, it costs about 9 or 10 cents extra freight to bring corn down here to Baltimore from the West.

MR. POWELL: With an organized industry you can handle large losses and the industry prorates the losses.

DR. DUVEL: We have found some grain men who are willing to stand part of the loss.

MR. POWELL: The fruit people simply deduct the losses and prorate them among five thousand shippers.

MR. SHANAHAN: We have got to do missionary work. I think perhaps we can bring about such a system in this work in possibly four or five years.

DR. DUVEL: We have been compelled to take up some of this work and demonstrate what value it was to the grain trade. We had some difficulty in getting the B. & O. railroad elevator company interested in our storage work.

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... 25 cents...

MR. BROWN: ... with that. I don't see how it is...

... 2-1/2 cents a bushel and 1-1/2 cents a bushel...

MR. BROWN: A difference of about 11 cents...

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MR. BROWN: With an increased quantity...

... the large harvest and the industry general in the...

MR. BROWN: We have found some grain men who...

... to send part of the loss.

MR. BROWN: The first people to buy the grain...

... from the grain men...

MR. BROWN: We have got to be in the market...

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... to possibly more or five years.

MR. BROWN: We have been compelled to take in some...

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... country interested in our...

Now they give us practically everything except the elevator. They are very much interested in the question of shrinkage and have given us the use of one of the large hopper scales. We have five hundred bushels in this scale which we weigh regularly to see what the shrinkage is from day to day. Also in connection with the Central Elevator Company at Baltimore, we have had a carload standing on the track for a number of days--corn which was shipped from Illinois with a high moisture content. It was transferred to us and weighed every few days on the large track scale, using the empty car as a check. In this experiment there was a shrinkage of something like 500 pounds in about 30 days. Data like that they are very much interested in, and they are willing to give us anything. We have also arranged with a large grain company in Nebraska for storage tests and experimental shipments from time to time throughout the winter. Most of the corn in Nebraska this year is still in the field, but as soon as it comes into the market this firm has agreed to store 15 or 16 thousand bushels of two or three grades, from which we will make experimental shipments from time to time to Baltimore and New Orleans, where the grain will again be stored. Whether they will be willing to live up to their agreement when there is a difference of five or six cents, I do not know. We have also made partial arrangements

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with a grain company at Terre Haute, Indiana, for experimental shipments of corn which has been artificially dried, having various percentages of moisture content. We hope to get at that work early next month, as soon as the shelled corn comes in. It is this winter-shelled corn which gives the most trouble. It goes into storage cold and, when it is taken out in the spring when the atmosphere is usually warm and moist, the corn is warmed up by coming in contact with the air, in handling, and consequently soon goes out of condition. We have made some chemical studies in cooperation with Dr. McClerc of the Bureau of Chemistry. He has made a number of analyses for us of samples of corn which have deteriorated in storage, and these analyses show that there is a marked change--more noticeable, perhaps, in the fats, sugar, and acid than anywhere else. In the corn in storage after it begins to heat the germ becomes black and the germination is practically reduced to zero in most cases and there is also a very high acid development due to the fermentation. Those questions, of course, must necessarily be taken up in connection with the others in order to get at the fundamental principle involved--to see what effect the bacterial flora and various kinds of fungi have, and also the chemical changes and their effect on the feeding value. But those problems we really have not started on; they are to come up in the future.

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... of ... and ...
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... we really have not ...
... in the ...

MR. POWELL: You have a big field there.

DR. STILES: The moisture content will vary in different sections of the country?

DR. DUVIEL: Of course, the corn in the South goes into the market with usually from 14 to 15 per cent moisture. With Louisiana, Texas and Oklahoma corn there is seldom very much difficulty. This year the moisture content is about 14 per cent. Northern corn taken south or east goes into the market with anywhere from 18 to 20 per cent of moisture, and, as soon as the weather warms up, trouble begins. It is a question of reducing the moisture sufficiently low to prevent fermentation and mold.

MR. SHAWHAN: I might say in this connection that we have made good progress in inducing the grain dealers to buy and sell corn on moisture content. The Grain Dealers' National Association has adopted a set of rules for grading corn according to its moisture content which have been adopted in many grain markets in which they are now buying and selling corn on the moisture content; at least they are setting a value on it which perhaps is not exactly right but which will adjust itself after a while.

MR. POWELL: I think the discussion today has brought out a good many points of view on lines which have the same underlying principles. There is probably more work being done in this Department on products after they leave the farm or after they leave the field than is being done

MR. POWELL: You have a very little...

MR. BELL: The moisture content will vary in dif-

ferent sections of the country.

MR. DAVIS: Of course, the corn in the South goes

from the north to the south, and it is in the north...

With Louisiana, Texas and Oklahoma corn there is

rather very much difficulty. This year the moisture con-

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MR. BELL: I have not seen any statistics that

show the moisture content in the different sections of the

country and only corn on moisture content. The grain

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for grading corn according to its moisture content which

has been adopted by the different associations in the

country and selling corn on the moisture content; as

soon as they are setting a value on it which perhaps is not

exactly right but which will adjust itself after a while.

MR. POWELL: I think the discussion today has brought

out a great many points of view on lines which have the

most interesting principles. There is probably more work

to be done in this connection to present a more uniform

the fact is after they have the field shown in being done

in any part of the country. Most of the work in Experiment Stations has to do with the production of crops and very little work has had to do with the handling of crops after they are produced.

MR. SHANAHAN: Since the Department has started the grain work some of the State colleges have taken it up.

MR. POWELL: That is true of the poultry industry, I judge from what I have learned that most of the work with poultry has had to do with the breeding and feeding of poultry and practically nothing with the handling of poultry after it is produced. There, I think, we have an opportunity in the Department, not only to standardize and broaden the scope of the problems as a whole in the various Bureaus, but we have an opportunity to make a very valuable contribution to this type of investigation in the Department which will set the pace for similar investigations all through the State institutions and in other countries.

MR. SHANAHAN: I think the marketing problems of our agriculture are as important to the farmer as any of the others.

MR. POWELL: Following these discussions today, the Committee which was appointed by the Secretary will have another session and will possibly have some general suggestions to make regarding the principles which might apply to the development of the work of this type throughout

the Department as a whole; also some suggestions to make possibly where there are points of contact between similar lines in the Department at the present time and where there is no real cooperation between the lines in the Department. I think that the greatest value of a committee of this type is that it affords opportunity to bring together various workers in the Department so that they get this informal interchange of ideas regarding methods of handling problems.

DR. STILES: Will there be any opportunity to have access to what has been said here today?

MR. POWELL: There will be copies made and a copy sent to each Bureau represented on the Committee, so that you will have an opportunity of getting at the data at any time.

DR. DUVEL: There is another question that comes up that worries me and that is in connection with our work on transportation. There are a number of questions that have come up that the railroad companies are afraid to take hold of on account of getting into trouble with the Interstate Commerce Commission. They are interested in our investigations of the transportation of grain and they are perfectly willing to haul the cars for us to any place in the United States.

MR. POWELL: They can do that if the stuff is owned by the Government.

The Department is a body which is not
usually where there are points of contact between
the lines in the Department at the present time and where
there is no real cooperation between the lines in the De-
partment. I think that the Department is a body
of this type in that it is not usually in touch
with various workers in the Department so that they get
this informal interchange of ideas regarding methods of

handling problems.

MR. STINE: Will there be any opportunity to have

answers to what has been said here today?

MR. POWELL: There will be copies made and a copy

sent to each Bureau represented on the Committee, so that

we will have an opportunity of getting at the data as

MR. STINE: There is another question that comes up

that relates me and that is in connection with our work

in transportation. There are a number of questions that

have come up that the railroad companies are afraid to

take hold of on account of getting into trouble with the

Interstate Commerce Commission. They are afraid to

and investigations of the transportation of grain and they

are perfectly willing to hand the case for us in any place

in the United States.

MR. STINE: They can do that if the rail is owned

by the Government.

DR. DUVEL: The interpretation that their legal department puts on it, I think, is that, if we are using that grain for experimental purposes and the regular charge is paid and the elevation charge is paid, after that it is in our custody and they can haul it back to division points and return--to the points shown on the original bill of lading.

MR. POWELL: You say they are afraid to do that?

MR. SHANAHAN: I understand they are willing to do it if the Interstate Commerce Commission will give them permission.

MR. POWELL: There is an exemption in the law which allows railroads to haul federal, state or municipal property at any rate they choose to fix, but not federal, state and municipal employees.

MR. DUVEL: The interpretation they put on that is that it also includes or is intended to include carloads in the custody of the Government--not necessarily owned. That is the interpretation they have put on it. They have asked for a ruling from the Interstate Commerce Commission. There are a number of questions that the Committee has discussed that I would like to have brought up direct to the Interstate Commerce Commission.

MR. SHANAHAN: I think as long as we intend to go into this transportation problem more deeply that it is a question that will affect all those lines of investigation

MR. DAVIS: The information that I have just

presented to you on it, I think, is that, if we are using

the same for experimental purposes and the nature of things

is such and the elevation changes in fact, after that it is

is not exactly and then we have it in the division point

and return--to the point shown on the original bill of

falling.

MR. DAVIS: You say they are afraid to do that?

MR. DAVIS: I understand they are willing to do

it if the Interstate Commerce Commission will have them

examination.

MR. DAVIS: There is an exemption in the law which

allows railroads to fail federal, state or municipal pro-

perty at any rate they choose to fix, but not otherwise.

and municipal engineers.

MR. DAVIS: The investigation they put on it is

that it also includes or is intended to include outside

is the custody of the Government--not necessarily owned.

That is the investigation they have put on it. They have

and the investigation they have put on it.

There are a number of questions that the Committee have

discussed that I would like to have brought up direct to

the Interstate Commerce Commission.

MR. DAVIS: I think we have as we intend to go

into this transportation problem more deeply than it is a

question that will affect all these lines or investment

and is very important. For instance, there is no good reason why the Government should be compelled to purchase several thousand bushels of grain because it can not otherwise be transported for experimental purposes. If we can get a loan of that grain from some one that owns it, with the understanding that we will compensate the owner for any loss for deterioration, I think the railroads should be given permission to transport it free while the grain is in our custody.

MR. POWELL: After a decision is rendered by the Interstate Commerce Commission we will have the basis upon which you can proceed, provided an adverse ruling is not made.

MR. SHANAHAN: That opinion has been asked by the legal department of the railroad company, not by the Department.

MR. POWELL: Not by the Department?

MR. SHANAHAN: No. But it is a question whether or not it would not be advisable for the Department to make a request direct for an opinion.

MR. POWELL: That is a question that is worth considering further.

DR. DUVEL: I bring this up for your Committee to consider. When I discussed the matter with Secretary Moseley he stated that they would be glad to make any favorable ruling, and, in his opinion, we would be justified in asking Congress to amend the law.

and is very important. The Committee, however, is in a position to make a decision on the matter.

It is a very important question of grain because it can not be otherwise be transported for experimental purposes. If we can get a loan of that grain from some one else, it, with the understanding that we will compensate the owner for any loss for deterioration, I think the matter should be given consideration to transport it from the grain in our country.

MR. POWELL: After a decision is rendered by the International Committee, we will have to wait for the result which you can proceed, provided an elevator is not built.

MR. SHAWHAN: That opinion has been asked by the legal department of the railroad company, not by the Department.

MR. POWELL: Not by the Department? MR. SHAWHAN: No. But it is a question of either or not it would not be advisable for the Department to make a request direct for an opinion.

MR. POWELL: That is a question that is worth considering further.

DR. DUBOIS: I bring this up for your Committee to consider.

It is stated that they would be glad to have any further information, and, in his opinion, we would be justified in asking Congress to amend the law.

MR. POWELL: In the handling of all of our fruit work we have simply borrowed the fruit. The charges are paid by the shipper. We send a man across the continent with the shipment to study the changes in temperature. The law allows messengers to accompany perishable products.

DR. DUVEL: You have the advantage there, of course.

MR. SHANAHAN: I do not think grain comes under that head. I don't remember how broad that clause is.

DR. PENNINGTON: Before we adjourn, I would like to say that the information which I have gained today will be very helpful so far as my work is concerned. I certainly never dreamed of the scope of the work.

MR. POWELL: I think we all feel the same way that Miss Pennington does. I think that is the case in a conference of this kind. We do not rub elbows enough to find out what our neighbors are doing along similar lines.

MR. RAWL: In regard to this matter that has just been presented, it seems to me that is a matter that a sufficient amount of information should be available upon so that, if it seems wise, the Secretary could present that matter to the Interstate Commerce Commission. I am wondering whether or not these same difficulties would involve other branches of work.

MR. POWELL: It would involve every branch of work where you want to carry on experimental shipments.

MR. RAWL: It seems not to have involved your branch of work.

MR. POWELL: Simple because we have been able to co-operate with an organized industry. We had a most exceptional condition to work under. I don't know where there is any industry that offers such opportunity; I don't know of any other agricultural industry anywhere in the world that is organized to the extent of the citrus fruit industry.

MR. RAWL: It seems to me we ought by some means to go into this question, if it is necessary, to collect or to make up a statement of the facts, so that the matter could be presented in the right form. It seems to me this has come to be one of the questions that will underlie every problem taken up.

MR. POWELL: I think our Committee will take that into consideration and then decide on just what way to handle it to the best advantage. One of the first things to do will be to get our own legal officer to define the limitations of the law. When he has done that we can see how much further we can go in having the present scope extended.

MR. TAYLOR: It should not be understood that all fruit is carried at the expense of the shippers' organization. All less than carload shipments, whether by express or freight, are paid by us in the regular way to

It seems to me to have involved a number of

MR. POWELL: Simply because we have been all so con-
cerned with an organized industry. We have a great

There is no industry that could be organized; I
don't know of any other agricultural industry anywhere in
the world that is organized to the extent of the cotton
textile industry.

MR. HAYES: It seems to me we ought to have some way to
bring this question, it is necessary, to present an
outline of a statement of the facts, so that the matter
could be presented in the right form. It seems to me this
has come to be one of the questions that will arise
every year from now on.

MR. POWELL: I think our Organization will have to
take into consideration and then decide on just what way to
bring it to the best advantage. One of the first things
we will be to get our own legal advice to define the
jurisdiction of the law. When we have done that we can see
how much further we can go in having the present scope

MR. HAYES: It should not be understood that all
that is carried on the subject of the agricultural organiza-
tion. All laws that concern agriculture, whether by con-
tract or otherwise, are paid by us in the same way as

to the transportation companies, and in cases of export shipments, where we have guaranteed minimum returns on carloads or less quantity, we have even taken the precaution to insure, that is, to take marine insurance on the shipment in transit not owned by the Department but guaranteed by it under a ruling of the Comptroller to the effect that the authority was sufficient to carry that protection, although that is contrary to the general rule that Government property can not be insured at Government expense.

MR. SHANAHAN: You took that insurance in the name of the Government?

MR. TAYLOR: I took the insurance in my own name as an official of the Government and carried marine insurance and all charges and received and distributed the proceeds to the owners of the fruit and then presented a voucher, if there was any deficit to be made good, showing all those facts and showing the items.

MR. SHANAHAN: Was it not necessary for you to be appointed a special disbursing officer?

MR. TAYLOR: Yes. The authority was included in the letter of authorization; that is, I had authority to guarantee shipments, and I handled it as a representative of the Department and at the risk of the owners of the fruit. I was not a bonded officer or disbursing officer.

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...all those facts and showing the items.

MR. TAYLOR: Was it not necessary for you to be

...a special dispensation; otherwise?
MR. TAYLOR: Yes. The authority was included in the
...of endorsement; that is, I had authority to grant
...and I handled it as a representative of
...and at the risk of the owners of the fruit.
I was not a bonded officer or disbursing officer.

MR. SHANAHAN: In other words, you were given authority to guarantee a minimum return and that implied authority to take insurance.

MR. TAYLOR: The Comptroller passes all vouchers. There was no specific authority to insure.

MR. SHANAHAN: Then, I understand there is a ruling that authority to insure was implied from the letter of authority.

MR. TAYLOR: Yes. It was marine insurance.

MR. SHANAHAN: I was wondering what ruling he would make on insurance on a car of grain in Baltimore.

MR. TAYLOR: I don't believe you would have any trouble.

The conference adjourned at 4:08 p.m.

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MR. TAYLOR: In other words, you were at the
day to conduct a business office and the United States
for the same purpose.

MR. TAYLOR: The business office was at the
time was in the office of the United States.

MR. TAYLOR: Yes, I believe there is a
great necessity to have the office in the United States
and the United States.

MR. TAYLOR: Yes, I believe there is a
great necessity to have the office in the United States
and the United States.

MR. TAYLOR: I don't believe you would have any
business.

The business office is in the United States.



